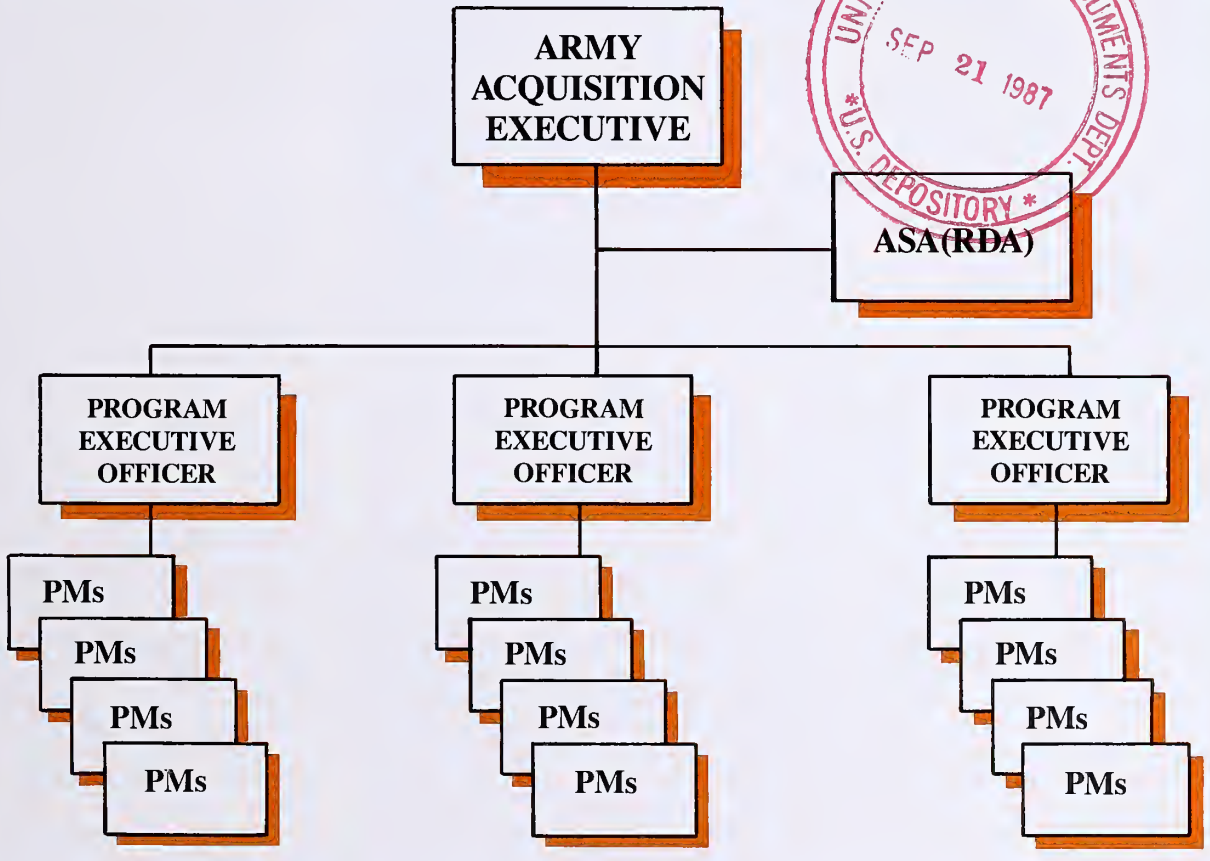
Professional Bulletin (Test)

ARMY RD&A BULLETIN

SEPTEMBER-OCTOBER 1987

RESTRUCTURING ARMY ACQUISITION



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Development
Acquisition

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PROFESSIONAL BULLETIN OF THE RDA COMMUNITY

This medium is approved for the official dissemination of material designed to keep individuals within the Army knowledgeable of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development.

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FEATURES

DEPARTMENTS

ABOUT THE COVER

The front cover diagram relates to an interview article with LTG Jerry Max Bunyard, AMC deputy commanding general for RD&A, in which he discusses the recent reorganization of the Army's acquisition structure. The back cover shows an armor crewman using a food tube developed by the Natick RDE Center. Nutritional assessment of such equipment is one aspect of health hazard assessment research conducted by the Army Medical R&D Command.

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Reorganizing The Army Acquisition Structure

An Interview With LTG Jerry Max Bunyard AMC Deputy Commanding General for RD&A

Q. ***General Bunyard, the purpose of this interview is to discuss the recent military reorganization as it applies to the Army's acquisition structure and the Army Materiel Command. Before going into details would you provide a little of the background of the reorganization?***

A. Sure. In July 1985, President Reagan directed the formation of a commission chaired by David Packard and responsible to study current defense management and organization in its entirety, including the budget process, the procurement system, legislative oversight, and the organizational and operational arrangements, both formal and informal, among The Office of the Secretary of Defense, The Organization Of The Joint Chiefs Of Staff, The Unified And Specified Command System, The Military Departments, and the Congress.

The acquisition management philosophy of the Packard Commission was to emulate successful commercial programs in government operations. The commission identified six conditions common to such successful programs:

- Clear Command Channels: A commercial Program Manager has a short, unambiguous chain of command to his Chief Executive Officer (CEO).
- Stability: The Program Manager has a fundamental agreement with his CEO as to cost, schedule, and performance. The CEO supports the program as long as the Program Manager adheres to his contract.

LTG Jerry Max Bunyard

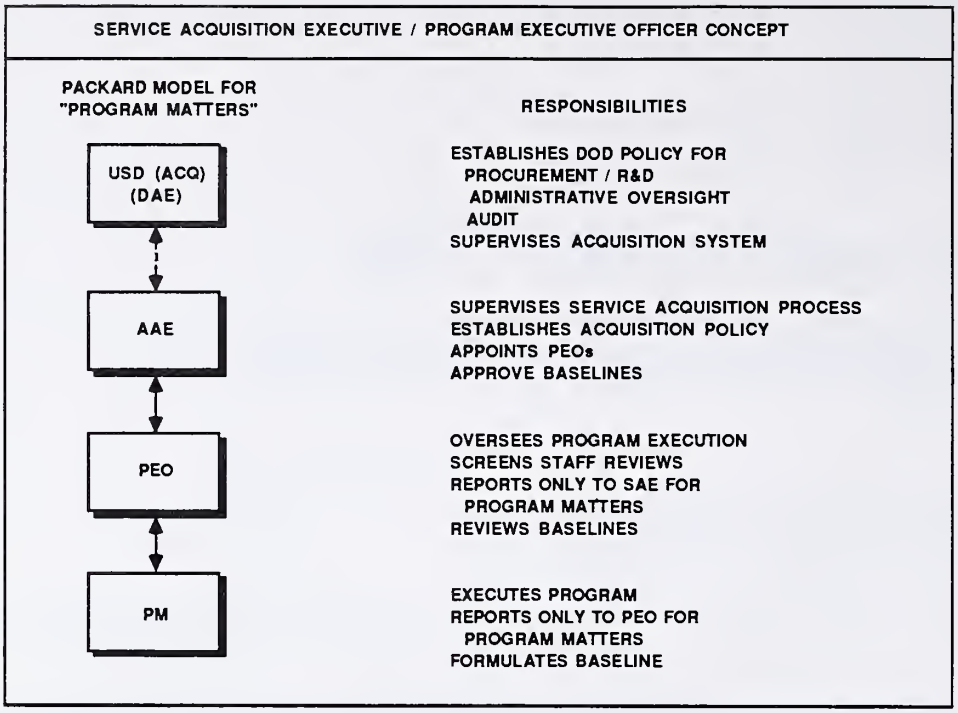

Figure 1

- Limited Reporting Requirements: A program manager reports only to his CEO typically on a management by exception basis, reporting only deviations from agreed upon cost, schedule, and performance.
- Small, High Quality Staffs: Time is spent managing a program with a select, small group rather than selling or defending it.
- Continuous Communications With Users: From program outset to completion, dialog is continuous to coordinate cost-performance trade-offs.
- Prototyping And Testing: Prototyping, early operational testing and "red teaming" are used in concert for the timely identification and correction of problems unforeseen at the program start.

After completing their study in early 1986, the commission made a series of recommendations that were approved by the President and incorporated into National Security Decision Directive (NSDD) 219 which directed that:

- Services appoint a Service Acquisition Executive (SAE).
- The SAE may appoint Program Executive Officers (PEOs).
- The Program Managers (PMs) are responsible to the PEO only.
- Program managers have one level of supervision between themselves and the Service Acquisition Executive and only two levels to the Defense Acquisition Executive (DAE).

These recommendations are included in the accepted Packard Model (Figure 1) depicting the process of control for program matters.

A second major driver in the reorganization effort was the Goldwater-Nichols Department of Defense Reorganization Act of 1986. Titles one through four and title six of the act deal with such things as DOD functions, Defense Guidance, duties and responsibilities of the Joint Chiefs of Staff, establishing a joint specialty for officers, and so on.

Title five has the most direct impact on the Army's organization in that it consolidated research, development, and acquisition, auditing, comptroller, information management, legislative affairs, and public affairs. It also mandated a 15 percent reduction in headquarters personnel strength.

There is little doubt that the net effect of these two directives has been to change the way the Army does its acquisition business. The advent of the Program Manager to Program Executive Officer to Army Acquisition Executive (AAE) chain of command and the consolidation of the research, development, and acquisition activities at secretariat level eliminated the old Deputy Chief of Staff for RDA (DCSRDA) Office. The Under Secretary of the Army was appointed as the Army Acquisition Executive and much of the DCSRDA was consolidated into the Assistant Secretary of the Army for Research, Development, and Acquisition (ASARDA) which became, in turn, the supporting staff for the AAE. As the reorganization evolves, we find the ASA for Installations and Logistics (I&L), ASA for Civil Works (CW), and Director of Information Systems for Command, Control, Communications and Computers (DISC4) also involved as a supporting staff of the AAE. I think Figure 2 gives a fairly good graphic portrayal of how the AAE will operate.

Q. ***How has all of this changed or affected the Army Materiel Command?***

A. The bottom line answer is not much. But to explain that broad assessment, I need to set the stage by looking back in time.

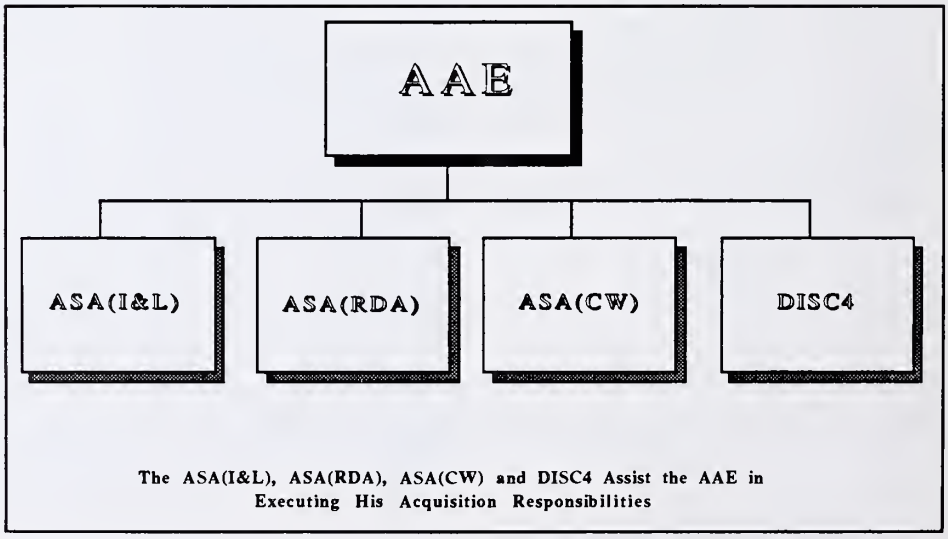

Figure 2

The Army Materiel Command was activated in 1962 as a result of Project 80, an OSD study that looked at the entire service structure from the systems analysis point of view.

Before project 80, Army materiel acquisition had been accomplished by the seven technical services (Ordnance, Chemical, Transportation, Quartermaster, Signal, Medical, and Engineer), each developing its own materiel almost independently. There was little overall coordination or fixed responsibility.

The formation of the Army Materiel Command in August of 1962 truly revolutionized the Army's materiel acquisition system. There was now a single command responsible for the entire life cycle of development, support and integration of Army materiel.

I bring up history only to make the point that the real materiel acquisition revolution took place a quarter of a century ago — not this year. In contrast, Packard and Goldwater-Nichols realigned decision authority and decreased the number of hurdles a program needs to get over. This is not so much revolutionary as evolutionary. The basic structure has remained intact while the responsibilities have become more focused.

What we are aiming at is a simpler structure for decision making — simpler and with fewer delays. We want to get people involved at a point where their input is instructive instead of later, when they can become linestoppers. The philosophy is to look at materiel development as a partnership of responsibility, of participation. That means a team effort with AMC Headquarters and the major subordinate commands as team members with the PEOs and PMs.

The reorganization does not usher the major subordinate commands and AMC Headquarters out of the materiel development and acquisition picture. Those organizations will continue to play essential roles in the entire life cycle of materiel development. We will still be very heavily involved in its support of Program Managers and Program Executive Officers through our laboratories, centers of excellence, and major subordinate commands by supporting the PMs/PEOs on a day-to-day basis.

The PEO/PM accomplishes his mission through the use of functional personnel and facilities supplied by the MSC. The MSC and HQ AMC are responsible for the development of the appropriate standards and for the competence and availability of functional personnel for all aspects of the weapons

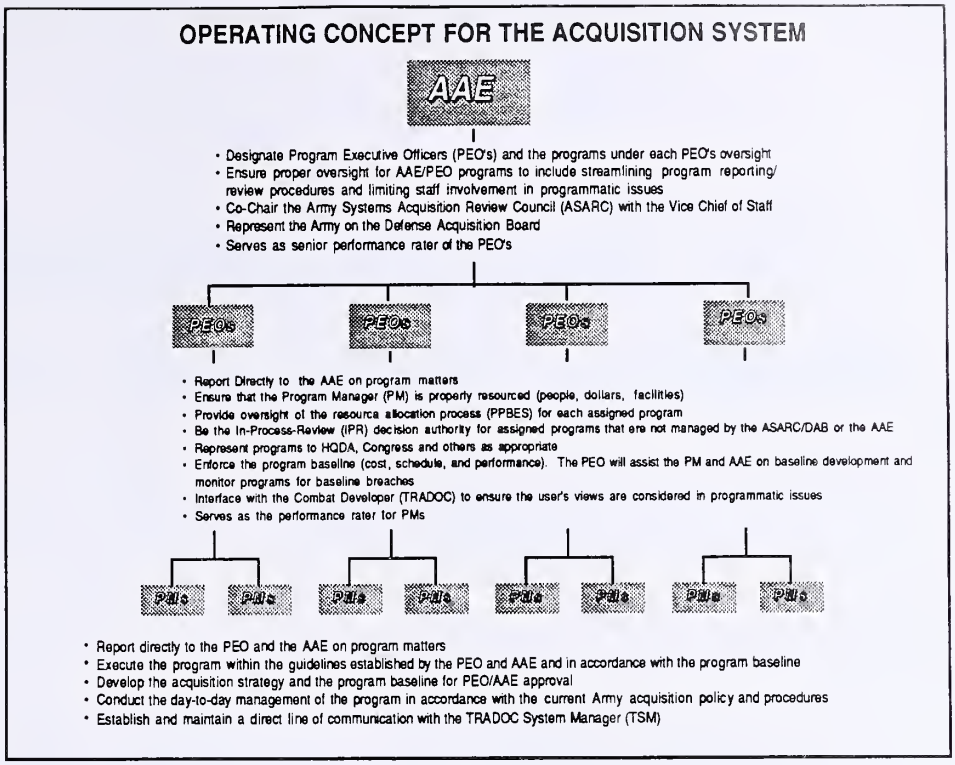

Figure 3

systems life cycle. AMC will be looking into those areas of policy, adequacy, accuracy and adherence as well as sufficiency and timeliness of support from a systemic point of view and will not be involved with the mechanics of the programs managed by the PEO/PM. Examples of the type of functional support that AMC/MSCs would provide include such things as procurement and contracting support in accordance with Head Contracting Authority (HCA) activities, test and evaluation, and integrated logistic support.

Q. ***What's expected of the PEOs/ PMs?***

A. The PEO/PM is responsible to the AAE for the programmatics of all aspects of development, production, fielding, sustaining and improvements of a system as depicted in Figure 3.

Program Managers are really entrepreneurs in larger organizations who draw on the strength and capabilities of the larger organization while operating a small, highly skilled and experienced staff that will focus on managing their program. They will be able to call on the functional area expertise and support of MSC staffs including labs and centers of excellence, but they will retain wide latitude in authority to operate their programs under their respective PEOs and the AAE.

Q. ***How is the present PEO/PM organization structured?***

A. There are currently 21 Program Executive Officers and two direct-reporting PMs (see Figure 4.) with approximately 120 programs which have earned the term, Executive Programs, for which they have oversight responsibility. Now that means not all acquisitions are to managed by this PM-PEO-AAE structure, but the major systems, as a minimum, will be. Cost and criticality will determine how a particular system will be managed pretty much as they do now. The present thought is that if the program is of such importance to require a Central Board Selected PM then it will be an Executive Program and will fall within the PEO managed structure. Non-PEO managed systems will be overseen by major subordinate commanders, much as they are now.

Q. ***How would you rate progress to date?***

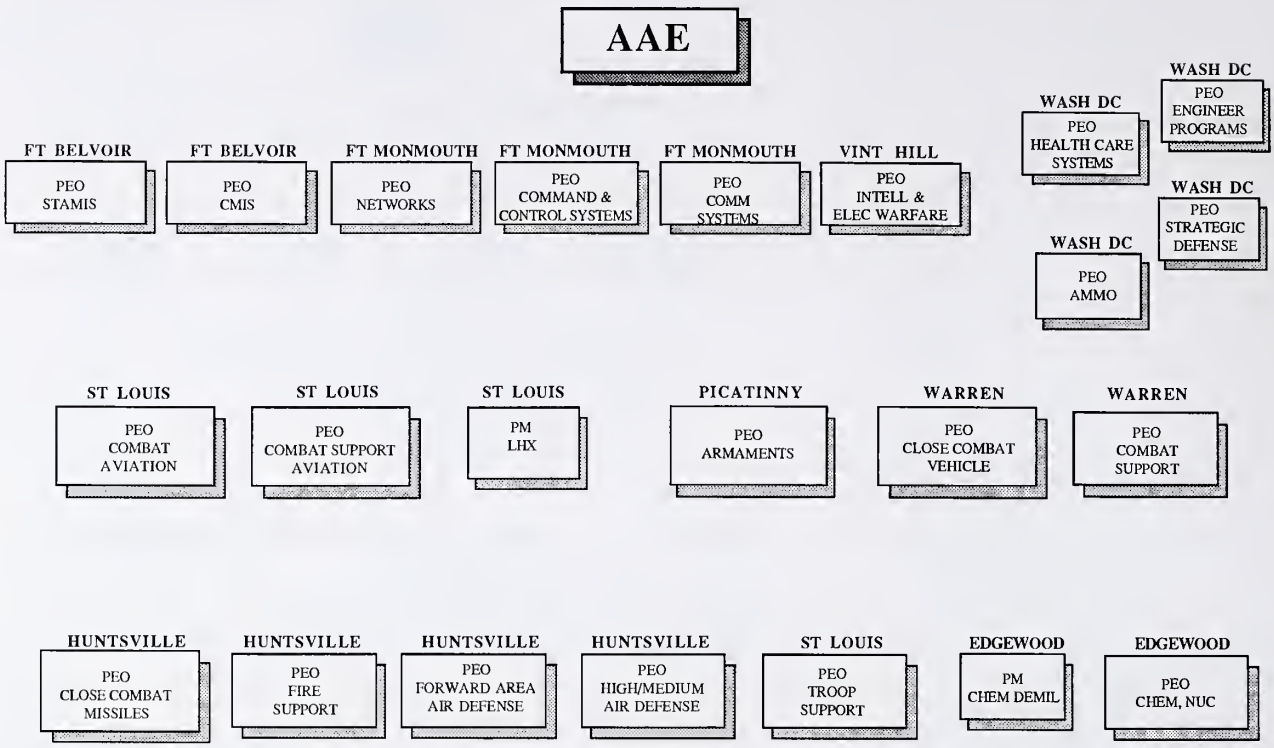

Figure 4

A. By and large good. Admittedly, there are things to be resolved and we are still wrestling with some tough problems in the implementation process such as meeting the requirements of the Planning, Programming, Budgeting and Execution System (PPBES), and adapting the PEO reporting system to report to the AAE instead of AMC. But that's to be expected in any new organizational refinement. All in all the outlook is positive and we are making very definite strides. I think the end result will be the PMs will enjoy an increased operational freedom; that MSCs and HQ AMC will be able to contribute significantly to the overall program; and that a smoother, more productive system will result.

Q. ***I understand that you have been asked to tie together acquisition information that is needed to run a process like this?***

A. Yes, and the reason is that right now there are many information management systems in use in the acquisition management community, and the tendency has been to proliferate. While this may be great at the micro level, when the information on cost, schedule, performance and other aspects of programmatics gets to the AAE who has to tie it together into a coherent, Army appropriation-level program for submission to OSD and Congress, the pieces don't fit. DCSRDA used to perform that integration function but DCSRDA no longer exists as an entity, and the AAE Office is not staffed to do it. The answer is to automate but currently no single existing system appears to meet all the needs for each level of acquisition management; neither can all those systems communicate with each other. The Acquisition Information Management (AIM) program is to correct all those deficiencies and provide a responsive information network to support the overall Army acquisition management mission. We are in the initial stages of organizing this and still have a long way to go. What we will not do is overlay another reporting system. That needs to be emphasized. Our goal is to pull what is needed from existing systems and develop a means for those systems to communicate with and integrate data from other systems. We want to be able to tie all programs into a baseline which is traceable to valid, fully documented materiel requirements, and available on a real-time basis to managers and decision makers throughout the RDA system. It's a tall order to say the least but we have good people working on the problem and it needs to be done.

Q. ***Is there anything else you'd like to add for our readers?***

A. As a matter of fact there is. I've been in the acquisition business for a good number of years and it seems to me that our current situation has a great many opportunities if we can only recognize and seize them. We are blessed with a lot of smart, dedicated soldier and civilian materiel acquisition managers and if this new way of doing business is to succeed, it will be because they apply their energies, intellect, and experience to the task at hand. We're certain to uncover glitches as we sort through the implementation because we'll be doing some things for the first time. We will probably even suffer a few "alligator bites below the water line" when something comes up that we haven't anticipated. But that should not and must not cause us to become discouraged or critical of the entire machinery. Our primary mission remains unchanged by any of this and with that as a motivator I think we can drive on and achieve the goal of a responsive, streamlined, efficient, and effective operation that puts the best war winning equipment in the hands of the best soldiers in the world.

The Health Hazard Assessment Research Program

By COL David M. Lam and MAJ Frank K. Grubbs

Introduction

The U.S. Army Medical Research and Development Command (USAMRDC) conducts numerous research programs in such diverse areas as pre-treatment drugs for chemical warfare defense, AIDS investigation, development of equipment to enhance the treatment of combat casualties, and vaccine development.

One facet of the command mission that does not result in a tangible product and therefore is not as well recognized is the research that is conducted in support of the Health Hazard Assessment Program. The objective of this research is to protect the soldier from harm from our own weapons systems, equipment, and the environment in which he trains and fights.

The types of research which are conducted in this area fall in the category of basic research and are funded under 6.1 and 6.2 program lines. Therefore, what is derived from the program is a data base which is used to set standards to ensure that the soldier will be able to use his weapons and equipment without adverse effects, under varying climatic conditions, throughout the world. In other words, the aim is to minimize use of potentially hazardous materials such as the napthenic content of fog oil and to provide maximum protection against injuries such as hearing loss or heat stroke.

Historically, when new equipment has been developed, the major concern on the part of the developer has been the functioning of the equipment. Often, potential health problems were not addressed at all in the developmental stage, and it was not until the weapon or materiel was fielded that health hazards became apparent. At that point it is almost impossible to correct problems by design or engineering changes.

Today, with the advent of MANPRINT and AR 40-10, (Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process), potential adverse health effects are being considered during all phases of the materiel acquisition cycle. In addition to acute exposures, long-term effects are also being studied.

Presently, research is on-going in evaluation of the health hazards posed by many developmental and fielded weapons systems and equipment, such as the M1/M1A1, the Bradley Fighting Vehicle, the M109 Howitzer, smoke gre-

M40 Protective Mask

nades, mortar rounds, rocket motors, field water supply systems, the laser rifle, chemical agent antidotes, the LHX, and various microwave and radio frequency generators.

Additionally, areas which affect soldier performance and effectiveness, such as vision standards, cold stress, heat stress, high altitude operations, nutrition, and psychological stress, are being studied.

Before we look at research which is being conducted on specific systems or equipment, let's see what is being done in direct support of the soldier.

The U.S. Army Research Institute of Environmental Medicine (USARIEM) has been assisting in development of a hand-held heat stress calculator. There, scientists have developed a model to predict physiological responses and human performance in a hot environment.

Currently, there is an operative comprehensive model which is programmed on a Hewlett Packard 41 CV hand-held calculator. Upon receiving deep body temperature and sweat loss input, the model is able to suggest an optimum work-rest cycle, the longest period of labor without rest, and the associated water requirements. This program will be tested by USARIEM at the JFK Special Warfare Center in the near future.

USAMRDC is also involved in studies of soldier performance in Continuous Operations (CONOPS) and Sustained Operations (SUSOPS). During CONOPS, combat will continue around the clock at a high intensity level for extended periods.

In SUSOPS, soldiers engage in CONOPS with very little opportunity for sleep. Investigations being undertaken in these areas include sleep research, pharmacological enhancement of performance research, and nutrition research.

Sleep

Sleep loss reduces mental capacity more than physical capacity; affects self-initiated actions more than externally driven actions; and often makes individuals sacrifice speed to preserve accuracy or vice versa, depending on the critical element of the task being performed.

At the Walter Reed Army Institute of Research, sleep research has shown degraded, but probably acceptable, military performance for short-term crises (seven days or less) with three to four hours of sleep daily. Acceptable long term (beyond a week) or steady state performance will require six to eight hours of sleep daily. Research has also shown that shift rotations should optimally allow a minimum of two weeks on the new shift.

WRAIR has also conducted research to support the fielding of currently available drugs which may sustain or enhance military performance. This research evaluates the effects of hypnotics to induce and improve sleep, arousal compounds to awaken soldiers rapidly from sleep, mental endurance enhancers to sustain mental performance for extended periods, physical endurance enhancers to sustain physical performance for extended periods, and anxiolytics to reduce fear and anxiety.

Initial laboratory studies are being performed to evaluate subject safety and the effects on performance. Laboratory studies will be followed by field studies to insure military efficacy, acceptability, and feasibility of use.

Nutrition

Another important area of research involves nutritional enhancement of soldiers' performance. Research is being conducted at USARIEM to determine the efficacy of nutritional strategies to reduce well documented decrements in military skills resulting from environmental and operational stress.

These studies include laboratory and field ration trails to evaluate effects of new ration systems and nutritional strategies on nutrient consumption, hydration, nutritional status, health, coordination, and physical and mental performance. Under this program, the Ration, Light Weight, 30 Day will be evaluated. A study is also planned on the effects of caffeine on endurance at high altitude.

Now, let us turn our attention to research that is conducted in direct support of the materiel acquisition process, looking first at blast overpressure research.

Blast Overpressure

Blast overpressure refers to the physiological impacts on the human body caused by exposure to the shock waves accompanying weapons fire. Studies in this area are being conducted through extramural contracts managed by the U.S. Army Aeromedical Research Laboratory (USAARL) and WRAIR.

The contracts at USAARL include the development of a data base for behavioral, histological, and electrophysiological information derived from animal models and audiometric and psychophysical data from human subjects. Physical characteristics of continuous noise environments will be correlated with patterns of hearing loss.

Aeromedical Research Laboratory contracts also call for research on the development of a broad data base to estimate the hazard to hearing resulting from exposure to blast waves or other high level impulse noise. The experimental approach will use a parametric strategy which is designed to study the contributions of individual blast wave exposure variables on the production of hearing loss, and to evaluate the effects of these variables in order to establish safe conditions of exposure.

Hearing function in chinchillas will be evaluated by pre- and post-exposure measurement of pure tone thresholds and by the analysis of cochlea prepared for anatomical study using traditional surface preparation techniques and scanning electron microscopy.

At WRAIR, contracts have been let which will attempt to define the non-auditory physiologic effects of blast overpressure and to determine the limits of human safety for exposure to impulse noise. This research ultimately seeks development of a mathematical model of the thoraco-abdominal response to blast waves. Comparisons have been made to animal models and preliminary results have demonstrated good qualitative agreement in simple one and two dimensional models.

Other studies will develop and validate more accurate human tolerance limits for impulse noise. A three pronged approach is followed. First, weapons noise is characterized by a standards-based analysis of the auditory hazard implications. Second, a direct validation study of hearing protective devices is anticipated with the ultimate development of an indirect method to determine their adequacy. Third, there will be an integration of exposure/injury data bases into revised regulations describing tolerance limits. These efforts are being facilitated by the development of an USAMRDC blast biology laboratory at Kirtland Air Force Base, NM.

The development of a data acquisition building is nearing completion, and human walk-up studies will commence in early summer 1988. The application of these tolerance limits will result in a reduction of hearing loss among crew members firing cannons, mortars, rock-

ets etc. Data from this research will also be used to support tests of armored vehicle survivability.

Applied non-auditory research on the effects of blast overpressure uses computer modeling techniques to define threshold levels of stress on air containing organs that will cause tissue damage. These stress levels will be used to establish damage risk criteria for occupational exposure to blast, to guide the design of protective material, and to plan for improved combat casualty care.

EEG electrodes being attached to participants in a Continuous Operations study. EEGs were used to monitor the degree of alertness of the subjects.

Lasers

Research is also being conducted to support the development and acquisition of lasers. The mission of investigating laser bioeffects and determining the medical implications of ocular trauma is assigned to the Letterman Army Institute of Research (LAIR). This laboratory is charged with providing a safety data base and developing ocular protection for the soldier.

The goals of laser research are to understand the nature and extent of laser injury mechanisms, to enhance medical management of laser associated trauma, and to develop the means of reducing these injuries. The laser bioeffects data base continues to expand as LAIR's research efforts keep abreast of the increased development and deployment of military laser systems.

Soldier performance degradation is evaluated in both laboratory and field studies via LAIR's blaser simulator (which mimics the laser's glare effect) and modified TOW launcher. Research results have led to design changes being made during the developmental phase of the Multiple Integrated Laser Engagement System. These design changes resulted in making the device much safer for the soldier.

LAIR continues to interact with system developers to insure that laser health hazards are characterized and minimized before fielding a system. By use of Raman spectroscopy, LAIR has identified the biomedical nature of current inventory ocular absorbers. In addition, laser bioeffects data for combat engagement models and for establishment of maximum permissible exposure limits have also been interpreted by this laboratory.

Microwaves

Also in the directed energy arena, WRAIR conducts microwave radiation research. The objective is to assess the effects of microwave radiation on living organisms, with emphasis on hazards and effects in the military environment. In order to accomplish this, WRAIR maintains frequent contact with those materiel developers concerned with research and development of microwave technologies. Such contact allows the researcher to select the appropriate frequencies and power levels for study. Very little is known of the physiological effects of delivering energy in an extremely high pulse in a very short time as opposed to delivering the same power in the continuous mode. In addition to system specific research, WRAIR is also investigating the interaction of non-ionizing radiation with organisms in general.

The basic thrust of both the laser and microwave research programs is to identify the hazards associated with directed energy systems and to provide the best possible protection from those hazards to the individual soldier. Significant strides have been made in determining the effects of and mechanisms for protection against ocular trauma. Research in high power microwave radiation is still in the data base development stage. Ongoing studies in both areas are directed at enhancing the protection and survivability of the soldier on the modern battlefield.

Vibration is one of the areas in which current civilian standards are not relevant to military applications. Consequently, USAARL is in the process of developing a bioeffects data base to establish a valid vibration exposure standard. The effects of helmet weight and center of gravity on head tracking performance in vibrating environments are being assessed in other studies. Seats and restraint systems retrieved from aircraft accidents are being evaluated to determine the effectiveness of design criteria in preventing injury.

Impact Injuries

Another ongoing research area at USAARL deals with impact injuries and design requirements to reduce or eliminate such occurrences. Crushable earcups for the SPH-4 helmet were developed and evaluated to enhance protection in the lateral head areas, while maintaining adequate hearing protection. Evaluations are also being conducted on the impact attenuation and retention capabilities of various Army helmets. Input has been provided to the design standards for the military motorcycle helmet and the aircrew integrated helmet system.

Eye Protection

Most often when one hears the term "eye protection" the first thing that comes to mind is the prevention of injury caused by solid objects. The suitability of polycarbonate ophthalmic lenses to provide protection for spectacle-wearing aviators against glass shatter in case of impact with night vision

A Bradley Fighting Vehicle crewman being equipped with breathing-zone sampling equipment for the capture of atmospheric samples of weapons combustion products in a test conducted by the U.S. Army Biomedical Research and Development Laboratory.

goggle tubes was evaluated from this perspective, and has led to a requirement for polycarbonate lenses in all aviator spectacles. There is, however, another facet to eye protection; the requirement to protect against laser hazards. Research is being conducted at both LAIR and USAARL to determine design criteria for and conduct optical evaluation of proposed protective materials and devices.

Weapons Combustion

The U.S. Army Biomedical Research and Development Laboratory (USABRDL) conducts research or manages extramural contracts in several areas that support the Health Hazard Assessment Program. One project involves evaluation of weapons combustion products in armored vehicles. Samples are collected during weapons firing exercises from the M109 self-propelled howitzer, the Bradley Fighting Vehicle, and the M1 and M60 tanks. In addition to general area sampling inside the crew spaces of these vehicles, personnel wear a survival vest that has been modified to contain air sampling devices.

To date, sampling for weapons combustion products has been completed in the M109 and the Bradley. Results from the analyses of the samples collected indicate that the potentially hazardous chemical concentrations were at or below detectable levels, and the hazards to the soldiers are considered minimal.

A study is being planned to characterize soldiers' exposure to fog oil and hexachloroethane smokes during training at the U.S. Army Chemical School. Soldiers will be wearing modified load-carrying equipment with sampling devices attached for breathing-zone sampling. Specific contaminants sampled will include both the vapor and the aerosol phase of fog oil smoke, zinc chloride from hexachloroethane smoke, and particle size characterization of both fog oil and hexachloroethane smokes.

BRDL recently conducted a study of diesel emissions at Fort Carson. Air samples for hazardous material analysis were collected in three different motor pools, each of which performed different levels of maintenance. The contaminants of interest were the solid and liquid particulates and the vapor components of diesel engine emissions. Concurrent to this study was a special study of personnel exposure which should provide some correlation and comparison of results. This study will also provide additional data on potentially hazardous trace pollutants. Sampling has been completed and analyses of samples are being performed. It is hoped that this study will provide an assessment of military work places containing diesel exhaust and associated health protection standards as well as protective measures to minimize health hazards to soldiers working in such environments.

Summary

In recent years there has been a renewed impetus to ensure that the Army provides the soldier with a level of protection that is commensurate with the advance in technology of the equipment with which he operates. The U.S. Army Medical Research and Development Command is dedicated to supporting the soldier by conducting appropriate research to establish a data base from which standards can be developed or improved and which will give direction to the development, design, and engineering of existing and new equipment so that health risks can be minimized.

Soldiering is inherently a hazardous profession, even without increased dangers posed by the soldier's own equipment. The involvement of USAMRDC and its subordinate laboratories in the health hazard assessment portion of the development of new equipment, and the consequent increase in the safety of our troops, is simply one of the many ways in which we provide "Research for the Soldier."

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MAJ FRANK K. GRUBBS is assigned as a staff officer in the Army Systems Hazards Research Program. He holds an MPH degree from the University of South Carolina.

Total Life Cycle Competition Strategy

By Barbara R. Ternak

Introduction

The passage of Public Law 98-369, The Competition in Contracting Act (better known as CICA), and subsequent legislation (e.g., Public Laws 98-525 and -577) have introduced sweeping reforms into the way competition must be accommodated in each phase of the acquisition portion of the total life cycle. Even more importantly however, this legislation has dictated formulation of plans for competition in the earliest phases of the life cycle.

AR 70-1

The Army has taken the "bull by the horns" to create the proper philosophical and regulatory environment for compliance with current legislation by interjecting competition into its dogma on "Systems Acquisition Policy and Procedures" as published in Army Regulation (AR) 70-1. The Army's principles of competition since CICA are known as the "Total Life Cycle Competition Strategy" (TLCCS), and were introduced in November 1986 in the revised version of the AR. The purpose of this article is to acquaint you with TLCCS and to identify where in a system's life cycle it comes into play.

The strength of any resolve resides in its definition and identification in day-to-day implementation. The Army's commitment is to total life cycle competition. Its execution is through the TLCCS. AR 70-1 defines the TLCCS as a strategy that emphasizes maximum feasible competition for the life cycle of a system to include support services, components and spare and repair parts.

The Total Life Cycle Competition Strategy must be conceptualized early in the requirements identification phase, then be developed and made an integral part of the Acquisition Strategy. It must reflect in-depth planning based on the Market Analysis and appropriate economic, technical, and logistical analyses to permit early decisions on how the entire system and its follow-on support will be provided while conforming to current law regarding competition in contracting. Rationale and justification for the selected strategy must be documented in detail.

AR 70-1 provides a road map on where and when competition, and more specifically, TLCCS, must be considered and documented to assure that optimum benefits are obtained from it during the life cycle. In this regard, your attention is drawn to the accompanying schematic of the Army acquisition process.

Documentation Requirements

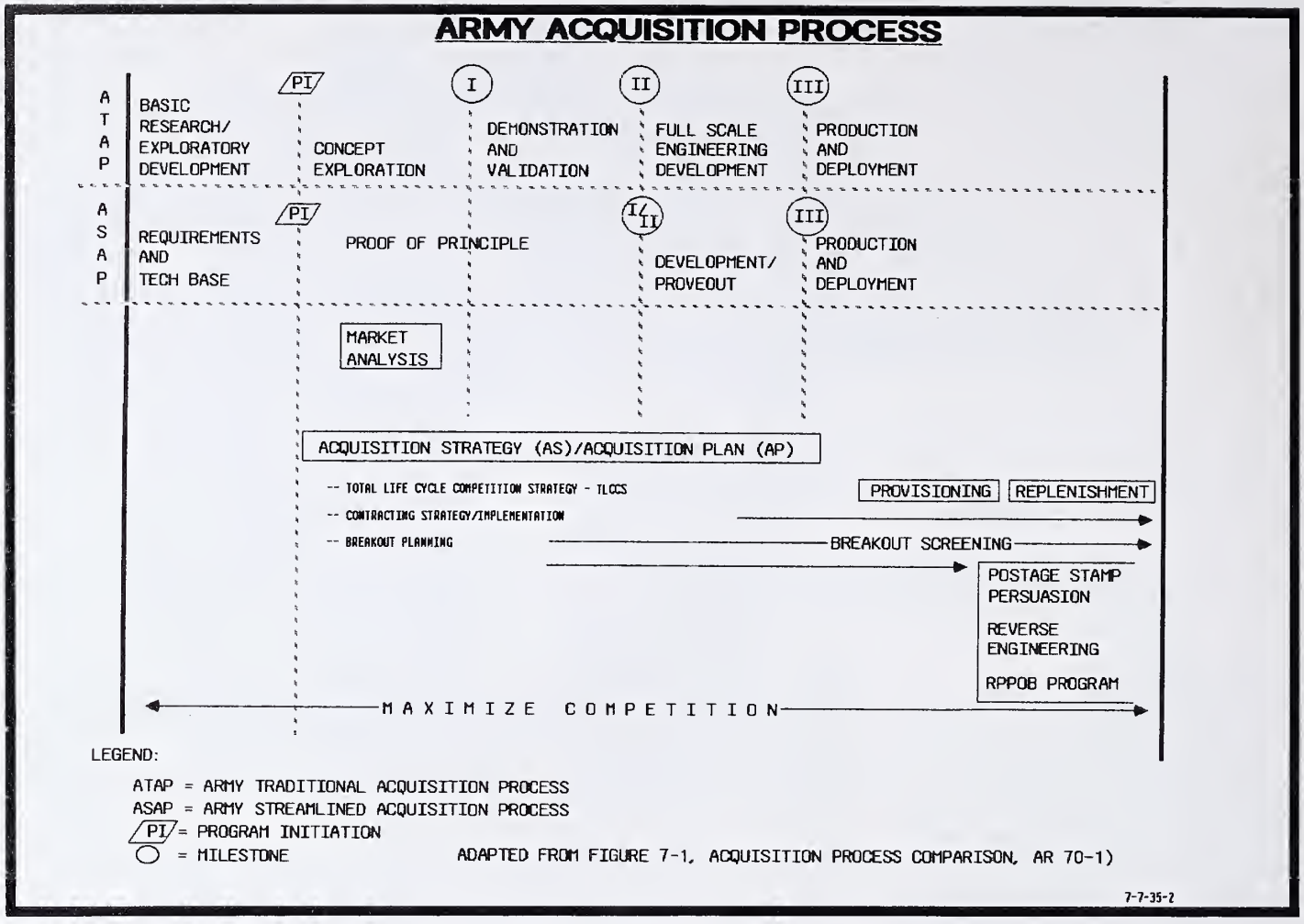
The seeds of competition must first be planted in the documentation of requirements, namely the Operations and Organizational Plan/Justification for Major System New Starts, emerging from the Research and Exploratory Development phases of an Army Traditional Acquisition Process program or the Requirements and Tech Base phase of an Army Streamlined Acquisition Process program. Approval of this documentation causes program initiation, which initiates the Concept Exploration phase of the traditional acquisition process or the Proof of Principle phase of the Army Streamlined Acquisition Process.

If the seeds are not planted in these requirements documents, competition will not happen very easily at any point in the life cycle. Additionally, the program manager will find approval channels full of barriers to program progress unless he adequately plans for maximum effective competition for his system or dully justifies other than Full and Open Competition at some or any phase of the life cycle.

During the Concept Exploration and Proof of Principle phases, a Market Analysis is conducted. Additionally, during these phases, an initial Acquisition Strategy and implementing Acquisition Plans are developed. The Acquisition Strategy must contain a clear TLCCS, and the Acquisition Plan must reflect a firm commitment to the fulfillment of that TLCCS. Program documentation must be developed, reviewed, and refined as the phases progress.

Phases

From the Concept Exploration phase of a traditional acquisition process program comes the Milestone I go-no-go decision to the Demonstration and Validation phase. From the Demonstration and Validation phase comes the Milestone II decision for the commit-



ment-to-program, Full Scale Engineering Development (FSED) phase. Correspondingly, from the Proof of Principle phase of a streamlined acquisition program comes the Milestone I/II decision for the commitment-to-program, Development/Proveout.

Again, as events occur and/or as the program progresses through these phases, program documentation must be developed, reviewed, and refined as necessary. Any revisions to the Acquisition Strategy and implementing Acquisition Plans must continue to contain a clear statement of the TLCCS, reflecting a commitment to maximum effective competition and/or fully-justified other than Full and Open Competition at some or any subsequent phase of the life cycle.

From the Demonstration and Validation/FSED phases of the traditional acquisition process or the Development/Proveout phase comes the Milestone III decision of go-no-go to the Production/Deployment phase. It is here that the commitment to competition during the long term phases of the life cycle, as laid down in the TLCCS of the Acquisition Strategy and (emergent) Acquisition Plans, is fulfilled.

The initial production phase is entered competitively; or exited with the tools for competitive system reprocurement; or possibly entered and exited in a non-competitive mode for both the system and its support parts and services, if that decision was fully justified, documented, and approved earlier.

It is in this phase, too, that the plans for maximum effective competition at the spare and repair part and support services level for the replenishment phase come to fruition: spares acquisition intergrated with production is followed by open competition replenishment procurement; or Joint Government/Contractor Breakout Screening occurs; or technical data for competitive reprocurement of spare/repair parts and support services is delivered; or less than Full and Open Competition procurement ensues.

Whatever the outcome of earlier decisions, the requirement for commitment to the principles of competition throughout the remainder of the life cycle is not diminished under the law. In the replenishment phase, a Breakout Program, operated under the guidelines of Defense Acquisition Regulation Supplement Number 6 (currently under revision), becomes the vehicle for compliance.

Earlier decisions for full competition must be maintained. This is achieved through continued maintenance of the technical data base (in-house or contractually), or perhaps in later years, via actions under the Postage Stamp Persuasion, or be Reverse Engineering, or via the Repair Parts Purchase or Borrow Program.

Earlier decisions for less than full competition must be reviewed as economic, technical, and/or logistic conditions change. Here, Postage Stamp Persuasion, Reverse Engineering, or Repair Parts Purchase or Borrow actions may be in order, as may new acquisition of technical data initiatives or Joint Breakout Screening efforts.

Conclusion

Full and Open Competition is the rule under current law. Exceptions must be

fully-justified. Maximizing Full and Open Competition for a system's life cycle requires thought, innovation, attention to detail, and, most importantly, a plan. As the saying goes, "If you don't know where you're going, it doesn't matter what road you take." The law tells us where we must go, and an effective TLCCS will provide the roads and bridges to get us there. Working together, we can make more and better competition a reality, and a way of life for Army systems.

For reference purposes, detailed discussions of TLCCS can be found in paragraph 3-18 of AR 70-1. TLCCS is pinpointed in the AR's discussions and illustrations of the phases of the life cycle. The following index is provided as a ready reference to those discussions and illustrations:

- Objectives, subparagraphs 1-5e(10) and m;
- Concept Exploration, subparagraph 3-4i;
- Demonstration and Validation, subparagraphs 3-5b and c;
- Full Scale Engineering Development, subparagraph 3-6f(6);
- Production/Development, subparagraph 3-8g;
- Materiel Acquisition Development Process Objectives, subparagraph 4-2e(3);
- Demonstration and Validation, subparagraph 4-5x;
- Full Scale Engineering Development, subparagraph 4-6j;
- Production/Deployment, subparagraphs 4-7c and ab;
- Acquisition Strategy, subparagraph 5-2b(1)(1);
- Preplanned Product Improvement, paragraph 6-5;
- Army Streamlined Acquisition Process, subparagraph 7-2f(4);
- Nondevelopment Items, subparagraph 7-3f;
- Market Analysis, subparagraph 8-4b(6);
- Appendix B, Simplified Life Cycle System Management Model;
- Appendix C Figures C-1, System Concept Paper, paragraph IX, and C-7, Acquisition Strategy, paragraph 2;
- Appendix D, Figure D-1, Decision Coordinating Paper, paragraph IX;
- Appendix E, Integrated Program Summary, Figure E-1, paragraph 5a(1);
- Figure 7-1, Acquisition Process Comparison.

Reference is also made to AMC Handbook 70-2 regarding content of other program documentation.

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Belvoir Aids Ammo Handling Problem

Engineers at the Army Troop Support Command's Belvoir RDE Center have gone back to the "basics" to solve a serious logistics support problem.

During peacetime, the maneuver unit's basic load of ammunition is prepositioned in remote ammunition storage bunkers. If a contingency arises, or a training exercise is called, the unit is required to travel to its designated storage site and upload the ammo onto organizational vehicles. Since some maneuver units don't have materials handling equipment, the upload must be accomplished manually. This requires breaking down pallet loads of ammunition, such as 155mm projectiles, propellent charges, and various small arms ammunition into man handable size loads. As a result, unit basic load/uploading becomes manpower intensive, time consuming, and fatiguing and degrades the maneuver unit's ability to rapidly respond.

To alleviate the problem, the center's Mechanical Equipment Division developed a UBL/UL set of equipment which allows two soldiers to combat-load a vehicle without forklift trucks or other powered materials handling equipment.

The set consists of a three-wheeled projectile hand truck, a modified commercial pallet stacker, an aluminum ramp equipped with a capstan and jib boom, a commercial fifth wheel wagon truck, and a standard pallet jack.

Three-wheeled handtruck is one of several basic ammo handling items engineered by the Belvoir RDE Center to upload ammunition from storage bunkers to vehicles in Europe.

The hand truck, pallet stacker, fifth wheel wagon truck, and pallet jack provide the capability for one soldier to obtain pallet loads from a stored position in the bunker and move them to the doorway. They also provide the capability to maneuver the pallets on the vehicle being loaded.

The ramp with capstan and jib boom allows two soldiers to move pallet loads from ground level to the vehicle deck. With this system, two soldiers can easily handle, maneuver, and upload pallet loads weighing up to 2,000 pounds.

The new equipment was demonstrated and tested recently by units of the V and VII Corps in Germany. Using one set, maneuver unit's troops reduced their upload time by half with far less fatigue. Technical data packages are being prepared for the procurement of the UBL/UL sets. Fielding is expected in FY 88.

Composites Technology

By Susan Dreiband

Introduction

U.S. Army Materials Technology Laboratory (MTL) engineers and scientists are using their arsenal of resources to aim today's composites technology toward tomorrow's Army. The same technology used in the sleek and ultralight Voyager aircraft, that enabled it to make its global trip, is being applied to defense purposes.

Composites, the youngest and most promising class of high performance materials, are ideal for lightweight use because of their specific strength and stiffness, fatigue resistance, damage tolerance, corrosion resistance, and design flexibility. Although in some cases, composite materials' initial costs are higher per pound than metals, composites have lower densities and higher specific strength and, therefore, require less material to perform a job. Additionally, composite components can be molded from fewer parts than metallic components. These advantages can greatly reduce production costs and save money right from the beginning of an item's life cycle.

Through its composites research and testing efforts, MTL is providing the nexus for introducing this class of materials as primary structures into Army weapons systems. Currently, composites are being fabricated and tested as part of the Composite Turret Program, the Composite Infantry Fighting Vehicle (CIFV) Program, and for the 155mm Lightweight Howitzer.

Located in Watertown, MA, MTL manages and conducts the Army's materials research and development (R&D) programs and is the Army's lead laboratory in the areas of materials, solid mechanics, lightweight armor, materials testing technology, and manufacturing testing technology. The MTL mission is directed by the U.S. Army Laboratory Command (LABCOM) in Adelphi, MD. LABCOM is the major subordinate command responsible for managing the corporate laboratories of the U.S. Army Materiel Command (AMC) in Alexandria, VA, which serves as the parent command for LABCOM and MTL.

The MTL Composite Infantry Fighting Vehicle.

Composites Structure

The structure of composites contributes to their unique characteristics. They consist of two or more components, based on a filler or reinforcing agent, in a polymer matrix or binder. Properties can be tailored to match any application based on the specific loading and environmental requirements involved.

Some composites, based on thermosetting matrix resins, are interspersed with long continuous fibers such as fiberglass, Kevlar, or aramid. When completely processed, these resins are locked into a stiff, unalterable shape, ideal for use in vehicle frames, body components, and other structures because of their high stiffness and strength-to-weight ratios. Moreover, armor composites use fabric reinforcements to achieve maximum protection against ballistic threats.

Composites have been used to replace parts of metal vehicles such as the sideracks of trailers. Additionally, MTL is managing the CIFV Program, which uses organic matrix/glass reinforced composites in place of the vehicle's aluminum structure. Organic matrix composites have also been successfully demonstrated in bridging and portable shelters as well as tent frames.

The laboratory has a breadth of materials expertise throughout its facilities which has been brought together in a cooperative effort to expand its composites R&D activities. MTL is assessing

methods for fabricating composites cheaper and faster and is testing them for fatigue life and other mechanical properties. Other facets of the laboratory investigate and design composite support system devices and materials, such as field repair kits, fire and chemical resistant components, protective coatings and related technologies. Still other areas of MTL investigate composite materials through a variety of characterization methods (chemical, structural, nondestructive testing, in-process (powders), x-ray, neutron radiography, chemical analysis and optical and electron microscopy).

Moreover, artificial intelligence and robotics are also being employed in the evaluation and life cycle prediction of composite materials, greatly enhancing the accuracy and efficiency of materials testing. Laboratory scientists are also researching the synthesis of flame-retardant additives for increasing flame resistance in composites for vehicle and aircraft equipment. Through in-house processing, MTL engineers and scientists are assuring the quality and effective design of materials for specific system needs.

Composite Turret

The demonstration composite turret program was successfully completed in 1986 and is hailed as a major pacing factor in the insertion of advanced composites technology into Army systems. The objective of this program was to demonstrate the advantages of thick-laminate, high-glass content composites for use as structural armor components of ground combat vehicles.

Several turrets were fabricated: one was tested structurally then subjected to ballistic evaluation; another was outfitted with turret components and was installed on an operational fighting vehicle for field testing, which included bump testing, 25mm gunfire tests and field endurance testing. This technology demonstration, carried out with assistance from the Bradley Fighting Vehicle Systems Program Manager's Office at the U.S. Army Tank-Automotive Command (TACOM) in Warren, MI, verified all the anticipated benefits of fabricating major ground combat vehicle structural components from composites. A weight reduction of 16 percent was achieved. Spall reduction was demonstrated by advanced threat ballistic testing. The composite turret durability was demonstrated during 1,900 miles of failure-free endurance field testing. Gun firing tests showed the composite turret had equal accuracy to the aluminum turret.

"The complete success of the turret program paves the way for the more ambitious program to fabricate an entire hull component from thick-section glass-reinforce plastic. The MTL Composite CIFV Hull contract is now underway to prove the technology in a highly stressed, dynamically loaded structure," says senior materials engineer William Haskell. "This demonstration program," he adds, "will provide Army vehicle designers the technical data base needed for them to incorporate composites into next generation combat vehicle development programs. Right now, the composite hull is MTL's number one priority."

Composite Hull

In fact, the laboratory recently awarded a $13 million four-year contract to FMC Corp., Ordnance Division in San Jose, CA. The contract will demonstrate thick laminate molding technology in the construction of lightweight combat vehicles. This composites program will, in cooperation with TACOM, ultimately transfer applicable composites technology to private industry, to assist in the design, structural analysis, fabrication, and evaluation of a composite hull structure using the CIFV as the demonstration tool for this technology.

The composite selected for this program includes Owens-Corning's S-2 fiberglass woven fabric impregnated with polyester resin for bonding. In fabricating the composite hull structure, four molded composite sections will replace 24 welded aluminum plates, while still incorporating aluminum reinforcing members for torsional rigidity. The field test data from the CIFV will be compared to existing data for the M2/M3 Bradley Fighting Vehicle. This will allow a direct comparison of a composite hull to a metallic hull.

The contract calls for FMC Corp. to conduct materials and processing refinement, hull design, tooling fabrication, and molding and outfitting of the composite hull, followed by 6,000 miles of field durability testing. MTL is conducting in-house projects involving materials improvement, polymer characterization, and quality control, complementing the contractor's efforts. All ballistic design data needed for the program were generated at MTL. MTL engineers are carrying out finite element analysis in the design of composites, processing refinements, ballistic evaluation of materials, effects of flammability as well as quality assurance as it relates to void content.

MTL will be sharing results from the demonstrator hull program with TACOM. Systems developers at TACOM will consider these results when planning the materials requirements for the next generation of ground combat systems. The composite hull will then be field tested for strength and rigidity at Camp Roberts, CA.

MTL researchers are also involved in developing standard methods to check the quality of the composite material. Among these are the characterization of prepregs (for the hull), quality control of starting materials which would determine their batch to batch variation, monitoring of the composite curing process, and measuring (nondestructively) the fiber content at various locations on a composite structure.

"We are trying to determine the acceptable limits for composite materials," says materials engineer Dr. Richard Shuford. "Nondestructive evaluation methods that apply to thin composite materials do not work with thick composite materials. We need to develop special methods for thick composites.

Tooling Costs

One of the biggest obstacles ahead involved in the production of composite materiel is the cost of tooling. "MTL is now working to develop processes to lower the fabrication price of composites," says research materials engineer Noel Tessier. "An automated process, for example, would drive down the costs."

Throughout the laboratory, machines that perform resin transfer molding, filament winding, injection molding, pultrusion, an autoclave molding are used extensively in composites processing. They are used in selecting the most effective techniques for producing lightweight rocket launchers, missile components, helicopter tailcones, and other prototypes of Army equipment.

Military Handbook

One of the most significant compilations of composite materials standardization is through the Military Handbook 17B which is being developed as a joint effort to the Department of Defense (DOD) and the Federal Aviation Administration (FAA). Handbook Coordinating Committee Chairman and MTL scientist Paul Rolston says that the

purpose of the handbook is to provide a standard source of statistically-based mechanical property data for current and emerging aerospace and other DOD composite materials.

"Basically, we are working to provide guidance as to how to come up with uniformly developed properties, how to test composite materials, what are statistically valid properties, and how to characterize them. The handbook will be published as three volumes. Volume I will provide guidelines for data development and analysis of composite material systems to be used in aerospace vehicles and structures, and other DOD weapon systems. Volume II will be devoted to engineering properties of lamina and Volume III will concentrate on engineering properties of laminates. This handbook will then serve as the industry standard for all suppliers to DOD and FAA."

New Howitzer System

Currently, another of MTL's more prominent efforts involves a joint program with the Army Armament Research, Development and Engineering Center in Dover, NJ. The program's aim is to produce a new 155mm howitzer system with firepower equal to that of current systems weighing approximately 16,000 pounds, but with a weight of only 9,000 to 10,000 pounds. This new lightweight howitzer system will be transported by helicopters which are expected to be operational by the 1990s. MTL's role in this program includes structural design analysis as well as the molding an assembly of the composite parts for the howitzer cradle.

MTL is conducting tests on composites using high loads that take into consideration gun firing and transport loads. The laboratory is also examining the durability of the graphite fiber reinforced epoxy material to survive the organic environment as well as its materials reliability.

"A system demonstrator is scheduled to be fabricated by January 1988 and will undergo a six-month field evaluation at Picatinny Arsenal (Dover, NJ)," says Donald Oplinger, project officer for the lightweight howitzer program at MTL. "In looking at problems associated with both organic and metal matrix composites, we are doing a tradeoff study as well as investigating problems associated with composite component non-recoiling dynamics. Overall, we have found that organic materials are best for trails and cradles and for parts that do not have bearings such as the carriage component."

A recent composites field repair kit, developed by MTL polymer scientist Dr. Stanley E. Wentworth, appears useful for aircraft and vehicle maintenance in the field. The kit allows operators and field units to repair equipment without transporting it back to the depot, thus enabling units to complete their missions without long delays. This patch combines a fiberglass fabric with the necessary resin matrix components. After the resin is spread over the fabric, the resistant patch is applied to the damaged area and allowed to cure. Within a matter of minutes, the repair is completed. Preliminary tests on the repair kit are being conducted by the Southern Research Institute in Birmingham, AL.

Conclusion

Like a knowledge-seeking argonaut engaged in a quest, the U.S. Army Materials Technology Laboratory is harnessing composites technology for the next generation of fielded defense systems, increasing the mobility, transportability, and effectiveness of our defense forces.

SUSAN DREIBAND is a public affairs specialist for the U.S. Army Materials Technology Laboratory, Watertown, MA.

READY 2000
to Revitalize Army Depots

To meet the challenge of supporting the modern Army, the U.S. Army Materiel Command (AMC) and the U.S. Army Depot System Command (DESCOM) have embarked on an aggressive modernization strategy.

The Revitalization of Army Depots for the Year 2000 (READY 2000) program is an extensive effort to modernize DESCOM so it will be fully capable of performing the depot mission for the Army by the turn of the century. If DESCOM is to meet the challenge of supporting the soldier in the field, modern state-of-the-art supply and maintenance facilities and equipment are a must.

The average age of facilities within DESCOM is 37 years. The average age of equipment is exceeding 15 years. Many World War II vintage facilities are not readily adaptable to efficient production layouts and workflow.

Under READY 2000, all depots will be working to develop an integrated modernization plan covering facilities, equipment, high-tech processes such as robotics and lasers, and automation management. Previously, each depot conducted its own effort, essentially competing with all other depots for limited funds which came from many appropriations. This made it difficult to modernize. READY 2000 provides a single modernization plan and budget line as well as technical parity with industry by the turn of the century.

The READY 2000 program will be headed by a new DESCOM modernization principal reporting to the commanding general. He will be responsible for the integration, management and marketing of the program. One of his major tasks will be the supervision of eight matrix management teams. Six of the teams, consisting of depot employees, will formulate requirements within the technologies of product and process definition, manufacturing planning and control, factory automation, supply, ammunition and base operations.

A seventh team, consisting of the six team chiefs, plus DESCOM headquarters personnel, will integrate the requirements. The eighth team will be comprised of the depot civilian executive assistants who will validate the findings of the READY 2000 program. All will be monitored by an advisory board of high-level executives from both government and the private sector.

The depot of the future will reflect the latest trends in facility integration, automated materiel handling, computer aided design and manufacture, flexible manufacturing, and information management. Increased productivity and high quality workmanship is a major goal.

Engineer Command and Control System

By CPT Roger Gerber and Charles Herring

Introduction

Engineer assets in division, corps, and echelons above corps areas are a vital part of the combined arms team in all combat operations. Combat engineers perform mobility, countermobility, survivability, and sustainment engineering operations, which reinforce the terrain to the advantage of friendly forces.

To be effective, the engineer must rapidly collect, analyze, and report information on the status of engineer assets and of critical facilities, then quickly plan engineer missions based on that information. Automated systems can assist the engineer in performing those tasks on the Air-Land Battlefield.

Tactical Command and Control

Automated command and control for combat engineers is one part of a much larger effort. The Army is currently developing an automated Army Command and Control System (ACCS). The tactical portion of this system, for use at corps level and below, is the Command, Control and Subordinate Systems which is divided into five, interconnected control elements: Maneuver Control, Air Defense, Combat Service Support, Intelligence and Electronic Warfare, and Fire Support. The relationship between these control elements is shown in Figure 1.

Each control element will have a system providing command and control of these operations. For the maneuver control element, the Maneuver Control System (MCS) includes force level control, command and control for maneuver elements and several subordinate systems. The Initial Force Level Control System, to be fielded as part of MCS Version 11, will integrate the five ACCS control elements at each echelon from corps down to brigade. The MCS subordinate systems are Engineer, Chemical, and Military Police. These systems will be able to communicate with each control element at every echelon via the force level control system. The MCS architecture is being designed by the Combined Arms Center Developments Activity and the MCS hardware and software are being developed by Project Manager Operational Tactical Data Systems (OPTADS).

The U.S. Army Construction Engineering Research Laboratory (CERL) is helping the U.S. Army Engineer School develop specifications for the combat engineer software which will be implemented using MCS hardware. CERL is also producing MS-DOS based pilot software called the Engineer Command and Control System (ECCS). This software will not interface directly with the Maneuver Control System but will provide many of the planning and reporting capabilities that engineer units require in the objective software system.

Engineer Requirements

To meet engineers' critical require-

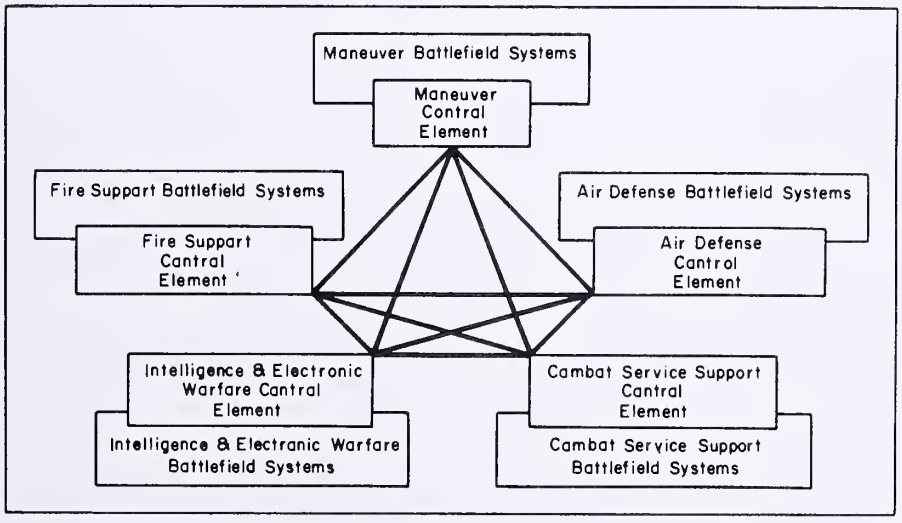

Figure 1

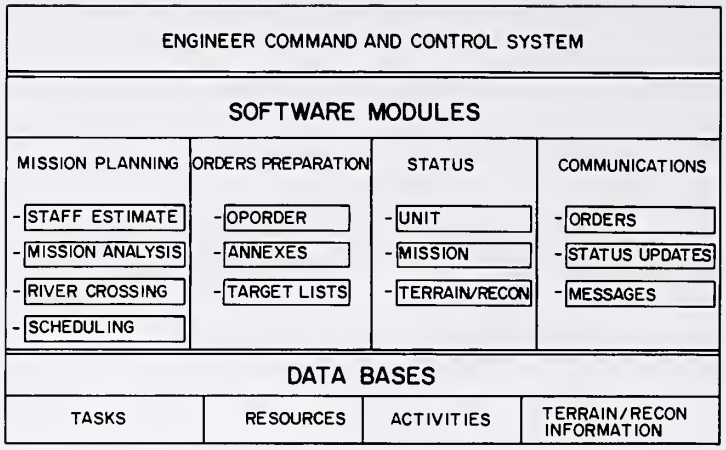

Figure 2

ments, ECCS must be able to do three things: keep maneuver commanders informed, assist engineer staff officers in mission planning, and provide engineer commanders with directing and controlling functions. Most importantly, ECCS must keep the maneuver commander and his staff at each echelon informed on the status of terrain features, the activities of friendly and enemy engineers, and the availability of engineer resources. This will require a link at each echelon between the engineer and the supported maneuver units. The information must be displayed with decision graphics that use standard military symbols and in messages that use standard NATO formats and U.S. Message Text Formats.

Second, ECCS must facilitate engineer planning. At each echelon, planning functions are shared between engineer staff officers at maneuver headquarters and the staff of the supporting engineer units. Planning is done at two levels of detail: engineer staff estimates and detailed mission planning. For each alternative tactical course of action being considered, the engineer staff officer prepares his estimate. Once the maneuver commander chooses a course of action, engineer orders are issued to supporting engineer units, who then perform the mission planning.

In coordination with the supported maneuver unit, a detailed plan is developed including an activity list, a work schedule, resource requirements, and target execution responsibilities. Once this plan is approved by supported unit headquarters, the planning process is complete. Automation can shorten this process by speeding the calculation of requirements and the generation and dissemination of orders.

Third, during execution of the engineer mission, engineer commanders and staffs at all levels must direct and control the situation. Directing includes passing guidance and orders to subordinate units. Controlling consists of keeping track of the status of engineer activities and resources, taking action based on this information, and reporting the situation to higher, lower, and adjacent units. Changes to the "battlefield geometry," whether they are caused by friendly engineers, enemy engineers, or natural actions, must be quickly communicated to battlefield commanders at each echelon. This information is kept current by many sources, including engineers, intelligence-gathering assets, and maneuver elements. This will require the automated system to quickly store, process, and transmit large amounts of data.

Capabilities

The ECCS version 1.0 pilot software will address both planning and execution requirements using the functional capabilities shown under the four software modules in Figure 2. The mission planning capability will be an enhanced version of the Combat Engineer Mission Management Module (CEM3) software previously developed by CERL. CEM3, developed in 1985 and 1986, assists engineer staff officers in identifying resource requirements for combat engineer missions. The execution capability will be provided by the orders preparation, status, and communications modules.

The mission planning module will permit the engineer planner to develop requirements and analyze alternatives in the use of engineer resources to support tactical missions. It will provide two levels of staff planning: staff estimate, and mission planning. The staff estimate part will help determine the engineer effort that would be required for alternative courses of action. Results can be used to recommend the best course of action from an engineer point of view and to assist in the task organization of engineer assets.

The mission planning part will provide detailed planning of engineer activities. The program will be able to calculate the resource requirements for many common combat engineering tasks and for any user defined tasks. Other essential information about an activity can be entered in the activity data base. Finally, the planning module will provide a resource-constrained schedule of activities and display the availability of critical equipment at any time along the schedule.

The orders preparation module will help the user format and store operation orders, engineer annexes, and target list appendices. Target lists and bills of materials will be generated from data developed during mission planning.

The status module will maintain data on unit status, mission status, and terrain data. The unit status function provides an automated means of maintaining mission-critical information. This information is then transferred to other headquarters using commander's situation report, and personnel, equipment, and logistics status reports. The mission status function allows the user to maintain current information on all ongoing engineer activities and to display or print this information. The original data in the mission status data base comes from activity information generated during mission planning.

The communication module will prepare files for updating other nodes in the network. These update files can be transmitted between systems, provided a communication link is established.

Planning and Analysis

A major responsibility of the engineer commander and staff is to plan how engineering effort will be used in developing tactical plans. The procedure for planning this effort is called the "engineer estimate." The purpose of the engineer estimate is to assess the engineer effort required to support an operation and provide a basis for the task organization of engineer resources. Results of this plan become the engineer input to the division and brigade operations order. The division engineer, assistant division engineer, brigade engineer, and the operations officer of the divisional battalion are responsible for this plan.

To produce a viable plan of action, the engineer must conduct a complex mission and task analysis which requires numerous calculations. The completeness of this analysis is constrained by the short amount of time available in a tactical situation. The ECCS will assist the engineer in this analysis.

The pilot version of the Mission Planning Module, or CEM3, provides for two levels of planning — engineer staff estimate and mission planning. The program contains the algorithms to calculate many common combat engineering tasks. The user may also define new tasks. At the estimate level, the program tracks squad hours, blade hours, and certain logistic items. The user selects the tasks to be accomplished in the mission and the program calculates the total resources needed and, based on the resources available, determines the time-resource constraints. The user can do what-if analyses by varying mission parameters such as duration and troop efficiency.

Once the initial estimate has been completed, the user can make decisions on engineer task organization and command relationship. The program can be used to do detailed mission analysis in developing a higher resolution of resource requirements. The mission analysis part of the program tracks resources by type, e.g., D7 dozer, M21 anti-tank mines. The user can do detailed resource analyses and what-if exercises. The program can produce a bill of materials for the mission by unit and as a total.

The user can place priorities on the mission tasks using the program's two-level priority system. The first level of priority is by area: mobility, countermobility, survivability, and user-defined. Within the area priority, the user can further prioritize the tasks as vital, essential, critical, and necessary. Placing priorities on the tasks is the first step in scheduling the missions.

The ECCS will contain a scheduler which will take into consideration the resource status of units. This application will allow the user to project the progress of engineer work 24, 48, and 72 hours into the operation.

The planning and scheduling programs will help generate the operations order by drawing information such as the task organization and activity lists from the mission data files. Part of the operations order can be formatted automatically based on the mission information. An online editor will be provided to complete the operations order.

Technology Transfer

ECCS version 1.0 will be distributed to all engineer units by the U.S. Army Engineer School in FY88. In addition, the software will be integrated into the 9th Infantry Division's command and control system communications software and will be tested in the 15th Engineer Battalion at Fort Lewis, WA. It will also be available on request from the Command and Control Microcomputer Users' Group at Fort Leavenworth, KS.

Feedback from users of this software will help CERL and the Army Engineer School define the requirements for the objective engineer subordinate system of MCS. The requirements specifications will be forwarded to the Combined Arms Center Developments Activity for inclusion in later versions of the Maneuver Control System.

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CHARLES HERRING is the principal investigator for combat engineer computer applications at CERL. He has a B.S. from the University of Mississippi and an M.S. degree in computer science from the University of Illinois. He is also an engineer officer in the U.S. Army reserves.

ETDL, NSF Undertake Joint Venture

The U.S. Army's Electronics Technology and Devices Laboratory (ETDL) and the National Science Foundation (NSF) have combined their resources in a major pioneering semiconductor research program. The joint venture is the first to be implemented under the Federal Technology Transfer Act of 1986 and the Presidential Executive Order (April 1987).

Through this agreement, which facilitates access to science and technology, funding will be provided by the NSF to select top-flight universities for professors and their students to use the extensive state-of-the-art microelectronics facilities of the ETD Laboratory, located at Fort Monmouth, NJ.

MG James C. Cercy, commanding general of the Army's Laboratory Command (LABCOM), and Dr. Nam Suh, NSF's assistant director of engineering, formally signed the agreement at a ceremony held at Fort Monmouth on May 27, 1987.

The first five academic institutions to receive $30,000 grants are Clarkson College, University of Maryland, Pennsylvania State University, City University of New York, and the University of Virginia. Doctoral students from these institutions will complete their thesis work and concurrently address a broad spectrum of Army research barrier problems in high-speed microelectronics and millimeter-wave communications for present and future systems.

According to Dr. Clarence G. Thornton, ETDL director, the strategy underlying this endeavor is to leverage the manpower resources of academia for Army technology base needs, while providing opportunities for top students to access laboratory expertise and do research using more advanced laboratory facilities than their universities can provide.

Federal laboratories, on the other hand, will benefit from the interaction with university researchers who will address critical Army problems as value added to the laboratories. ETDL has been at the forefront in encouraging the integration of graduate students and professors into government exploratory research laboratories, thereby effectively changing the way it, and other government laboratories will be doing business in the future.

Dr. Gerald J. Iafrate, director of ETDL's Electronic Devices Research Division, and principal coordinator of the ETDL-NSF mutual effort, stated that the five programs currently underway are aimed at the fabrication and characterization of novel semiconductor materials and device structures for high-speed microelectronic applications.

Significant Events in Acquisition Streamlining

By Glen Buttrey

In the November-December 1986 issue of *Army RD&A Magazine,* I wrote about the Army Streamlined Acquisition Process (ASAP) in practice. At that time I had the opportunity to send a message that ASAP was beginning to bear results, and offered a few examples of those results.

This time I hope to convince you that streamlining is catching hold in the imaginations and mindsets of the acquisition community, and to update you on some of the more recent and most significant events.

Now that the basic guidance documentation on the ASAP has been published (see AR 70-1 and AR 71-9, plus the Materiel Acquisition Handbook, AMC/TRADOC Pam 70-2), it seems to me that we in the Army acquisition community have a unique challenge on our hands — specifically, that of translating streamlining policy, ASAP, into action in a big way.

We have had some notable successes already, and later in this article I will describe some individual programs and initiatives that deserve particular recognition.

ASAP Primer

Now I want to provide an update on a few of the things or events that have occurred recently or are ongoing with regard to streamlining.

We recently finished work on an ASAP "Primer" that discusses elements of streamlining and provides a reference/source for further information. The primer has been distributed to the major subordinate command streamlining advocates and will be provided on an as requested (limited) basis.

We intend to incorporate comments/suggestions and eventually publish the document as a circular or handbook in the fall. For instance, as the practical application of the Program Executive Officer reorganization emerges, we will need to discuss those ramifications in the primer.

Acquisition Streamlining Conference

Earlier this year, in Washington, DC, the Office of the Secretary of Defense, in conjunction with the Electronics Industries Association, hosted the third annual National Conference on Acquisition Streamlining. Keynote speakers were Richard Godwin, under secretary of defense (acquisition) on the first day, and Dr. Robert Costello, assistant secretary of defense, (acquisition and logistics). Principal Army attendees were: James R. Ambrose, under secretary of the Army and Army acquisition executive; Robert O. Black, Army advocate for acquisition streamlining; Darold Griffin, Army Materiel Command (AMC) deputy chief of staff for production; BG Billy J. Stalcup, AMC deputy chief of staff for supply, maintenance and transportation, and COL Joseph Saffron, AMC assistant deputy chief of staff for procurement policy and analysis.

The conference objective was to help expedite an effective and lasting implementation of DOD's acquisition streamlining initiative through panel discussions and presentations on a broad range of related topics. Foremost among these was the status of a pending Federal Acquisition Regulation (FAR) case devoted to acquisition streamlining (the case has been forwarded for final review by the Defense Council), and the status of MIL-HDBK-248B on streamlining (submitted for formal coordination).

Army presentations included a discussion of the broad range of ASAP initiatives, treatment of ongoing initiatives to eliminate counter-productive requirements, and Army streamlining initiatives related to translating requirements into contracts.

Army Acquisition Executive Ambrose delivered brief remarks on the current Army acquisition environment as it relates to streamlining requirements, and then participated in a question and answer period that marked the first time the service acquisition executives and Dr. Costello have participated together in a public forum.

Godwin presented OSD Acquisition Streamlining Excellence Awards in recognition of two individuals or programs in each service demonstrating significant achievement in streamlining during 1986. This recognition was a result of nominations received from the acquisition streamlining advocates, and the formal nominations made by Army Acquisition Executive Ambrose.

The Army recipients were: COL Thomas J. Kunhart, PM Army Tactical Missile Systems, and Judith Fite, chief, Acquisition Policy Branch, AMC, who accepted on behalf of the Army Acquisition Policy Team for creation of the Army Streamlined Acquisition Process.

Additional Recognition

Since OSD requested only two nominations from each service, several Army nominees failed to achieve proper recognition at the conference. On behalf of the Army advocate for acquisition streamlining, I would like to use this opportunity to recognize some of those whom we feel deserve an Army streamlining honorable mention.

- The Army Command and Control System (ACCS), Communications-Electronics Command (CECOM). ACCS is a nondevelopmental item (NDI) acquisition of software and hardware, which places heavy emphasis on the use of commercial specifications and incorpo-

rates a proof- of-principle phase involving the troops who will use it in "hands on" testing.

- Mobile Subscriber Equipment (MSE) at CECOM. The MSE is a major program utilizing the NDI acquisition concept, with a particular emphasis on the use of functional specifications and early troop demonstrations.
- Training and Doctrine Command (TRADOC). Especially under the leadership of MG George Krausz, and through the efforts of his streamlining advocate COL Tommy Grier, the Office of the Deputy Chief of Staff for Combat Developments at HQ, TRADOC implemented policies and procedures which streamline requirements development and ensure early and continuous management involvement throughout each materiel acquisition program.
- Test and Evaluation Command (TECOM). In the spirit of challenging unnecessary requirements, TECOM established a process which achieved significant cost avoidance by eliminating duplication in test facilities.
- M43 Chemical Protective Mask — Armament, Munitions and Chemical Command (AMCCOM). This program obtained substantial schedule reductions through the early participation of pilots in providing "hands on feedback" and design and operational guidance, plus the use of production quality tooling on all prototypes.
- Unmanned Aerial Vehicle — U.S. Army Missile Command (MICOM). This is another example of a successful NDI acquisition which also achieved considerable success with specification and data tailoring. Data items and standards and military specifications were cut in half through the identification and elimination of unnecessary and counter-productive requirements.
- M119 Howitzer — AMCCOM. This program utilized an NDI approach to proceed from Milestone I to production in 19 months.
- Information Systems Command (ISC). ISC emphasizes an increased use of NDI and the minimization of test requirements throughout their procurements.
- Ben J. "Jack" Risse from MICOM. Mr. Risse devised a method of weapon system management at MICOM that provides for more efficient utilization of command resources. Establishment of the Systems Analysis and Evaluation Office as the MICOM focal point for program acquisition strategy provides detailed acquisition management planning information for project managers.

These are just some of the examples of how the acquisition community is beginning to put ASAP to work. I'm sure there are others. If you have a streamlined program that you feel deserves recognition, get in touch with your streamlining advocate, or contact the Acquisition Policy Office at HQ, AMC.

Training

One of the most important tools for institutionalizing the streamlining initiative is to provide training in the concepts and techniques involved. To that end we have begun development of a modular course devoted to instruction in all facets of ASAP. This course is designed to be handed off to any and all organizations involved in Army acquisition, and is intended to increase the awareness and acceptance of streamlining principles.

Development of the course will result in prototype presentations intended for both the National Capitol area and on-site demonstrations at designated major subordinate commands. Upon completion of these demonstrations, the contractor will provide a written program of instruction and plans for follow-on classroom instruction.

The Army Logistics Management Center has undertaken a parallel effort aimed at incorporating an ASAP program of instruction into the Mission Area Managers Course. This effort will include a one-hour exportable videotape discussing the essential elements of ASAP.

Subject Matter Assessment

The AMC Management Engineering Activity is conducting a Subject Matter Assessment (SMA) on ASAP interfaces. The SMA began at MICOM and is evaluating four specific interfaces within the ASAP concept: funding policy and practices, tracking and lessons learned, technology integration, and market analysis. Since technology integration, market analysis, and funding are so closely related, the SMA will address each area to identify the responsibilities and processes used to integrate technologies, and funding approaches to alleviate the problems identified.

Conclusion

In conclusion, let me leave you with one final thought. Anything as complex as the materiel acquisition process — influenced by law, politics and funding, as well as being dependent upon interaction among many technical and functional activities — cannot be successfully streamlined by superficial or fragmentary means. Bandages and facelifts will not do it. That is why we have opted for the systemic, whole-process approach of institutionalizing ASAP policy in the Army regulatory structure. As I said earlier, now the challenge is to translate that policy into action at every opportunity.

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HDL Generates Record Microwave Power

Using the Aurora flash X-ray simulator as a power supply, a team of physicists led by Harry Diamond Laboratories (HDL) have generated 20 billion watts of microwave power. HDL spokesmen say that is the highest microwave power level ever produced in a free-world laboratory setting.

Aurora, which HDL operates for the Defense Nuclear Agency, was used to drive a high-power microwave source called a reflex diode. Spokesmen say the power was generated inside a large metal tube in a pulse of about 50 billionths of a second long at a frequency of one billion cycles per second.

"This work has important applications in the arca of testing Army systems for survivability in extreme electromagnetic environments," an Army spqkesman said.

The landmark experiment, the spokesman said, was performed by HDL scientists with scientists from Los Alamos and Sandia national laboratories in New Mexico. It was sponsored by the Strategic Defense Initiative (SDI) Organization's Office of Innovative Science and Technology, and received recognition as an outstanding SDI laboratory accomplishment by the American Defense Preparedness Association.

Desert Mobility Vehicle System

By George Taylor III and Doris L. Hudgins

The RDE Center of the U.S. Army Tank-Automotive Command (TACOM), Warren, MI, has modified 12 High Mobility Multipurpose Wheeled Vehicles (HMMWV) and designed and fabricated one-ton cargo trailer prototypes in support of a program to develop a desert mobility vehicle system (DMVS).

Under way for the past year and a half, the DMVS program is a joint effort involving TACOM and the John Fitzgerald Kennedy Special Warfare Center and School at Fort Bragg, NC. The Kennedy warfare center is a U.S. Army Training and Doctrine Command agency responsible for training special-operations forces and developing special-operations doctrine, materiel and force structure.

Special-operations forces have a requirement for a ground vehicle system to perform extremely long missions. A team, with no additional support, needs the equipment in order to get in quickly, perform the mission, and get back out quickly. Special-operations forces do not presently have such a system. Therefore, air support is their only means to move quickly. In certain scenarios, however, aircraft do not provide the optimum mobility, and ground vehicles will be required.

The Army Development and Employment Agency (ADEA) at the 9th Infantry Division, Fort Lewis, WA, was tasked to assist the Kennedy warfare center by making user evaluations of the special forces materiel requirements. ADEA, in conjunction with TACOM, suggested that they "take a look" at the HMMWV-trailer combination.

The modified HMMWV and trailer would be an interim approach to meeting the newly created desert-mobility requirements. The long-term objective is to eventually replace it with a totally new system having certain additional capabilities not yet technically feasible.

The interim DMVS would consist of the modified HMMWV as the prime mover, the high-mobility trailer, and a 250-cc or 350-cc motorcycle. It would be capable of traveling long distances in an arid, cross-country environment and performing a variety of missions. The trailer would carry extra fuel, food, water, ammunition and, for some missions, the motorcycle for a reconnaissance role.

User evaluation testing last summer at Fort Bliss, TX, of two M998 Cargo/Troop Carriers (with minor modifications) revealed that the HMMWVs met most of the minimum requirements. At that point, the warfare center asked the TACOM-based Light Tactical Vehicle Project Manager's Office to make a few modifications that would be needed to enhance the vehicles for their special application.

The warfare center requested a weapons mount for the Cargo/Troop Carrier, but one was not currently available. Subsequently, it was agreed that a mix of vehicles would be used. Thus, six M1038 Cargo/Troop Carriers (M998 with winch) and six M1026 Armament Carriers underwent modifications. No major changes were made to the basic power train or the four-wheel independent suspension that provides the HMMWV with its excellent high-mobil-

Three-quarter view of the Desert Mobility Vehicle System (DMVS) — TACOM-modified HMMWV and fabricated trailer.

ity characteristics. The improvements, which for the most part could be called "enhancements," were low-cost minor changes, and standard components — already in the supply system — were used whenever possible.

Modifications to the HMMWVs included:

- replacing the driver's, right front and right rear passengers' seats with bucket-type seats for better comfort during cross-country operation — replacements are 3/4-ton commercial utility cargo vehicle seats;
- replacing two-point seat belts with a five-point restraining system to give better support and keep crew members in their seats while traveling cross-country at high speed — standard commercial five point harnesses were used;
- adding the capability to store six "jerry cans" (capacity of five gallons each) of water in the area normally occupied by the left rear seat — storage racks were fabricated in the RDE Center;
- installing a lighted magnetic compass — a standard supply item, to provide off-road navigation capability;
- installing an interior rearview mirror in the vehicles;
- mounting a U-shaped block on the floor behind the accelerator to capture the heel of the driver, enabling him to keep his foot on the accelerator during severe cross-country operations;
- installing wire-mesh protection for lower radiator hoses to protect the hoses from cross-country wear and tear;
- installing hand-holds for the two passengers to grasp and steady their bodies during rough travel conditions;
- adding two more cargo tie-downs to keep cargo from bouncing around; and
- adding a 12-volt portable air compressor — for use in inflating tires. The HMMWV uses run-flat tires. However, they were never intended for long-distance, cross-country operation while deflated.

In addition, a better dashboard gauge set was requested by special forces. An engineering effort which the RDE Center oversaw has provided improved analog and digital gauges. The gauges were installed in four vehicles for evaluation. A critique of two completed vehicles — one Cargo/Troop Carrier and one Armament Carrier — was performed by representatives of the Fifth Special Fores Group, Fort Bliss and the Kennedy warfare center in early May.

With ADEA as overseer, the test of the modified HMMWVs took place at Fort Bliss in July and August of this year. Four of the vehicles — two Cargo/Troop Carriers and two Armament Carriers, underwent a 1,000-mile user appraisal of the DMVS concept, performing various missions during cross-country operation.

Side view of the DMVS.

TACOM efforts to develop a DMVS trailer began last fall at the warfare center's request, after tests revealed that no current light-duty Army trailer would be suitable for a desert-mobility application. At the outset of the project, a review of the DMVS requirements led to a decision to modify the design of an experimental trailer developed at TACOM in 1984 for the 9th Infantry Division, Fort Lewis, WA. The 1984 project resulted in the design and fabrication of 14 trailers for Fort Lewis.

Designated the XM52, this trailer, which has an 1,100-pound capacity, is a carriage that was designed to transport the 4.2-inch M30 heavy mortar while being towed by a HMMWV squad carrier. It features a trailing arm, torsion-bar suspension that gives it cross-country mobility like that of the HMMWV. Also, its tires, wheels and shock absorbers are common to the HMMWV.

The XM52 is 133 inches long, 85 inches wide and 39 inches high, and has a tilt bed and hand-powered winch that make loading and unloading the mortar quick and easy. Modifications to the XM52 design included changing the bed, taking away the winch and adding a cargo box. A heavy-duty suspension was designed to upgrade the 1,100-pound payload capacity to 2,000 pounds.

Two efforts were completed in TACOM's RDE Center in support of the DMVS trailer. In one of these, technicians converted two existing XM52 mortar carriages into utility trailers which participated in the user appraisal of the DMVS concept this past summer at Fort Bliss, TX.

These modified trailers had the same 1,100-pound payload capacity as the original XM52s, and therefore did not meet the DMVS payload requirement. But they did enable the user to evaluate the overall system — the prime mover, trailer and motorcycle — to find out under actual conditions if it can perform the types of missions it will be expected to perform.

The second effort involved the design of new components needed for a 2,000-pound-capacity DMVS trailer and the fabrication of four trailer prototypes from scratch. The prototypes will be completed in October, and shipped to the Yuma Proving Ground, AZ, where they are now undergoing a four-month feasibility test. If the trailers pass the Yuma test, the next step will be to procure some 150 of them for use by special-operations forces.

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An Update on NDI

By Spencer H. Hudson

Introduction

The use of nondevelopmental items (NDI) to satisfy defined requirements (after doctrine changes, training changes, organizational changes, or product improvements have been considered) is a preferred Army acquisition alternative and is one of the better methods to acquire equipment in an orderly, expeditious manner under the Army Streamlined Acquisition Process (ASAP). Earlier NDI definitions have been evaluated and there are now two general categories and a third level of effort within the overall definition:

- Category A. This category applies to off-the-shelf items (commercial, foreign, other services) to be used in the same environment for which the items were designed. No modification of hardware and/or operational software is required.
- Category B. This applies to off-the-shelf items (commercial, foreign, other services) to be used in an environment different than that for which the items were designed. Modifications to hardware and/or operational software are required to militarize and/or ruggedize the item.
- Third Level of Effort. This approach emphasizes the integration of existing/proven components and the essential engineering effort to accomplish systems integration. This strategy requires a dedicated research and development effort to allow for system engineering of existing components, for software modification/development, and to ensure the total system meets the requirements.

There is no longer a need for an "NDI label" for the former category C2, in which a new system was assembled from components where most of the components existed but some components required development. This approach is simply streamlined development under ASAP, featuring significant NDI contributions to the overall strategy.

At this point, it is important to emphasize that NDI is a part of the overall acquisition streamlining process, not a separate process. It is equally important to note that, while many events or documents can be simplified or eliminated through streamlining, the short cuts are not automatic-streamlining, to include NDI, and entails careful consideration of the full range of acquisition requirements. Conscious tailoring actions permit us to pare down to the essential and visible documentation in the acquisition strategy.

The NDI concept requires some additional explanation and the clearing up of some misperceptions within the process. Making an NDI decision is not always a simple, easy process. Needed data is not always readily available even though the materiel developer continuously does market surveillance. Market surveillance is a systematic effort to gather information/data to develop and maintain awareness of market place activities and products with potential for Army use. It is accomplished by the research, development, and engineering centers, laboratories, and the U.S. Army Security Assistance Command with oversight provided by the U.S. Army Laboratory Command at Adelphi, MD.

The oversight begins with the long-range technologies and notional/conceptual systems and continues until a requirement is generated utilizing the technology or system.

Concept Formulation

As the requirement begins to evolve, generally in the form of an operational and organizational (O&O) plan, the concept formulation process begins within the Army Materiel Command (AMC) and the Training and Doctrine Command (TRADOC). AMC and TRADOC work together during concept formulation. It includes:

- a Trade Off Determination (TOD) which is performed by AMC, using market surveillance data to provide TRADOC with information on the materiel options available to eliminate a battlefield deficiency;
- a Trade Off Analysis (TOA) which is performed by TRADOC based on thrust, doctrine, organizational concepts, and the materiel possibilities identified in the TOD;
- the Best Technical Approach (BTA) which is prepared by AMC in response to the findings of the TOD and TOA; and
- the Cost and Operational Effectiveness Analysis (COEA) for major programs or the Abbreviated Analysis (AA) for non-major programs which is performed by TRADOC using results of the TOD, TOA, and BTA. The COEA/AA will identify the relative cost effectiveness of these alternatives to the decision makers at the milestone decision review.

Market Investigation

During this same period, after O&O

approval, AMC conducts a market investigation to determine if there is a product in the market place that satisfies the requirement and to gain enough data for preparation of the request for proposal. If the NDI approach cannot be used, market investigation serves to identify nondevelopmental assemblies/components that could be used in a development solution to the materiel need.

The resulting acquisition strategy must specifically address the consideration that was given to NDI and, if a new development is required, explain why NDI could not be employed. The written justification is necessary to assure the potential use of NDI has been completely investigated because of the advantages provided by the use of NDI.

These advantages are: low technical risk, shared R&D costs, reduction of time-to-field, and increased Army strength as a customer in the commercial market.

Reduced Acquisition Time

As stated, an important advantage of NDI is reduced acquisition time. This is accomplished, in part, by minimizing formal Army testing. General policy is not to test when existing data (contractor or other sources) provides us reasonable and acceptable answers to the test issues and requirements addressed in the Test and Evaluation Master Plan (TEMP).

It is imperative that independent evaluators get involved early, participate in the program, and provide independent evaluation plans and independent evaluation reports. It is also imperative that the testers be involved early to assure the planned test and evaluation effort satisfies the testing requirements and to assist in determining when existing test data are acceptable.

To minimize testing, maximum use should be made of existing data sources (e.g., commercial testing, user data, independent evaluation agencies). If commercial market place testing or other existing data sources do not address the intended military environment and equivalent information cannot be obtained from existing sources, a test program in accordance with the TEMP must be conducted.

Integrated Logistics

Integrated Logistics Support (ILS) is often the most difficult aspect of NDI acquisitions. ILS demands day-to-day top management attention, both by the materiel developer and the combat developer, and cannot and must not be sacrificed to hardware schedule and cost constraints. Even though NDI provides many advantages, it also presents some unique problems to the ILS community.

- Reduced lead time means less time to prepare organic support.
- Supportability issues must influence source selection since design is already established.
- Standardization goals may be adversely affected.
- Suitability and adaptability of existing support elements must be determined.
- Suitability of interim contractor support should be determined as part of the requirements formulation.

To compensate for some of these unique problems, the Army may choose to rely on contractor support either on an interim or permanent basis, or may choose a one-time buy of spares to ensure support of the product over the entire life cycle, or may choose any number of innovative strategies to assure the integrated logistics support is truly addressed and all potential problem areas are completely covered.

Let's look at the decision process to determine the suitability of contractor support, either interim or permanent. The decision to use contractor support should be based on overall analysis and trade off alternatives performed during early evaluations. Results must clearly show that the best concept for support is the optimum among all of the feasible alternatives. The evaluation must also assure the concept provides the required support in both peacetime and wartime scenarios and is the most cost effective method.

Competition

One additional fact that we must not lose sight of is competition in contracting. Competition "mandates" require that we maximize competition on everything we buy, but also provides specific circumstances which allow us to purchase under other than "full and open" competition. In addition, there is some flexibility that allows up front decisions permitting non-competitive, smart buys when a complete and effective analysis has been done. Naturally, these exceptions must be clearly justified. First, we must show that we have done everything feasible to maximize competition for the life cycle of the system in question and secondly, that our resulting decision is in the best interest of the taxpayers and the Army, given the data and facts available.

Unique Challenges

A discussion of NDI would not be complete without mentioning the unique challenges placed on the acquisition community. To begin with, our basic materiel requirements tend to be idealized. That's one reason why we've had problems going for an NDI solution — both threat assessments and resource practices tend to the most advanced technology in the materiel solutions. In recent months, however, this trend has begun to change due to costs constraints and the recognized need to get equipment to the troops faster.

The combat developer has begun to negotiate and relax specifications whenever possible. The materiel developer has many opportunities to review, evaluate and challenge the requirements and assist the combat developer in establishing the most realistic requirement. The combat developer is also striving to involve industry early by inviting their participation and review during requirements formulation. This means staffing draft requirements documents with industry and letting them know early what we need. The end result is that the Army is becoming a smarter buyer. We know better what's practical and can intelligently trade-off specifications for what's available in the market place.

The materiel developer must be the honest broker, bringing the combat developer and industry together to arrive at the best match and fit — hardware to requirement. In order to accomplish this, we must defeat the "not invented here" attitude. We must change the idea that if we didn't develop it, it's not good enough.

The logistician's challenges are twofold: One is supportability. It does us no good to deliver an item that can't be repaired due to lack of spare parts. A second concern in availability. The NDI must represent current technology and be available to us, without future configuration changes, for the intended life cycle. We don't want to select an item only to later find that the vendor intends to discontinue or significantly upgrade that item with enhancements we don't need.

Conclusion

We've come a long way in the past months. Current NDI guidance is now available in AR 70-1, Systems Acquisition Policy and Procedures, in an AMC/TRADOC Pamphlet 70-2 (chapter 17), and in a pending Office of the Secretary of Defense NDI handbook. Many related regulations have been revised to reflect ASAP/NDI and the updates will continue as opportunities become available.

Beginning this quarter, AMC will produce an NDI tracking report using the Army Management Milestone System (AMMS) maintained by the Materiel Readiness Support Activity. This report will provide a snapshot of Army ongoing acquisition programs as reflected in the AMMS data base. It will also identify those systems specific to each subordinate command, provide a chart of each system or the reason the system cannot be charted, provide specific acquisition milestones with lessons learned, and some cost information in the future.

As a continuation of the NDI efforts, we are striving to use commercial components in lieu of developmental components in a maximum range of programs, in an attempt to reduce acquisition costs without degrading military effectiveness. Designing in commercial components is a viable approach to make the end item less costly thereby minimizing production costs and/or operation and support costs.

We realize that the decision to acquire a nondevelopmental item or a commercial component is the end product of a process. It's essentially an exercise in risk assessment. We must weigh the pros and cons of nondevelopmental acquisitions and pick a prudent course. We use the established life cycle steps and phases within the streamlined process as the mechanism for gathering data and making smart decisions in a shorter time frame. We think of NDI as one strategy for tailoring the life cycle process so we can extract the maximum from what's already in the market place.

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D-SAFE Supports Army in Korea

Improved soldier support in the Far East is the purpose of the Depot System Support Activity Far East (D-SAFE) at Camp Market in South Korea. D-SAFE was activated by the Army Materiel Command in October 1985. Its missions include performing overflow intermediate general support and depot level maintenance of Army equipment through contracts with the Republic of Korea industrial base; serving as a processing point, staging area and hand-off location for total package fielding items; acting as the agent for modification work orders and as the AMC focal point for warranties.

D-SAFE is under the operational control of the commander of AMC-Far East. Its commander reports to the commanding general of the U.S. Army Depot System Command.

The activity receives its equipment maintenance requirements from the Eighth U.S. Army in Korea or the U.S. Army, Japan. In coordination with the Korea Contracting Agency, contracts are awarded with local industry to perform the work.

Currently, such contracts include the repair or overhaul of automotive equipment, materiel handling and construction equipment, tactical wheeled vehicles, M915 10-ton truck tractors, the M-113 family of armored personnel carriers, D7F bulldozers, communication-electronics equipment and aviation equipment such as OH-58 T-63 engine compressors.

Additional contracts provide for the application of M259 smoke grenade launchers to M-113 armored personnel carriers and the processing of more than 1,000 High Mobility Multi-Purpose Wheeled Vehicles (HMMWV) for fielding.

The current contract workload is more than $12 million with an estimated savings of $7 million. Additional savings will be realized with the establishment of more than $15 million in new contracts.

D-SAFE manages its nationwide contractors through two facilities, one at Camp Market (D-SAFE North) in the northwestern part of the republic and the other at the Changwon Industrial Complex near Pusan (D-SAFE South). The D-SAFE South includes a large warehouse used as a central storage area and an alternate staging site for total packaging fielding items.

In addition to its maintenance mission, D-SAFE performs the processing staging and hand-off for the majority of force modernization equipment sent to units in Korea. D-SAFE has three total packaging staging areas in Korea: Camp Market (Bupyong), D-SAFE South (Changwon) and Camp Seattle (Inchon). When the unit receives its gear, it's ready to go. An example includes the "options" added to new HMMWVs for the Eighth U.S. Army. The command required unique items on each vehicle such as locking fuel caps, rifle brackets, radio installation kits, and cab and cargo covers. Through local contracting to install the items, the units received completed vehicles at the hand-off.

During its first year, the activity fielded 13 new systems. Future fieldings are scheduled for Boat Bridge Erectors, Heavy Expanded Mobility Tactical Trucks, M939A1 series five-ton trucks and M113A3 armored personnel carriers.

As the modification work order agent for AMC major subordinate commands in Korea, D-SAFE handles the modification work orders that are applied to U.S. Army equipment to improve their operational capability. As the agent, D-SAFE coordinates the Letters of Notification and modification work field plans with the major command whose equipment requires the modifications.

The activity negotiates the location and schedule for the modifications and maintains the data base on which items of equipment have been modified. D-SAFE also receives, stores and issues work order kits.

Most of the new equipment entering the Army inventory includes a manufacturer's warranty on the complete system or major assemblies of the item. D-SAFE is AMC's focal point for all warranted equipment issued in the Far East. The activity provides assistance to Warranty Coordinator Offices for claims and submissions procedures and processes actions and claims for the major subordinate commands.

D-SAFE will continue to expand its mission capabilities to provide even better service in support of the U.S. Army soldier in the Far East.

The preceding article was written by LTC Nicholas M. Laiacona, former commander of D-SAFE. He is currently attending at the Defense Systems Management College, Fort Belvoir, VA.

The Field Assistance in Science and Technology Program

By Angie F. Levroney

The U.S. Army Materiel Command's (AMC) Field Assistance in Science and Technology Program (FAST), now more than two years old, is firmly established and field commands realize its benefits, according to Gregory Cirincione, who was among the first group of science advisors in the program. Cirincione recently completed a two-year tour as an AMC-FAST technical science advisor to the Eighth U.S. Army in Seoul, Korea. He now serves as special assistant to the director of Harry Diamond Laboratories (HDL) in Adelphi, MD.

The AMC-FAST Program resulted from White House and Office of the Secretary of Defense studies on Federal/DOD laboratory effectiveness. The studies found that new technology was being poorly transitioned to the field and poorly understood by operational forces. It was also determined that laboratories that had a close interaction with users were the most effective.

In response to these findings, AMC assigned laboratory and research, development and engineering (RDE) center personnel as science advisors to the Army's major commands to improve the coupling between operational forces and the R&D community. The program was first called the Army Science Assistance Program.

Cirincione explained that the science advisor serves as the principal staff advisor to the field commander on science and technology matters. The advisor recommends short-term, quick reaction technology investigations to solve technical problems in the operational environment identified by the command's troops, principal staff, or commander-in-chief. For problems that require a more substantial effort, the science advisor assists in articulating and writing the technical requirements, and provides that feed-back to the technology base program.

Before he got to Korea, Cirincione didn't know what kind of technical problems he would encounter or if the Eighth U.S. Army would see a real need for a technical science advisor. There was an agreement between AMC and the major commands that if the field commanders didn't feel the program was beneficial, they wouldn't have to take on another advisor.

Another major concern for Cirincione was that the staff and troops of the Eighth U.S. Army feel that he was one of them and not an intruder from another organization. "That was difficult in the beginning, but when I gained their trust, I was really able to contribute," he said.

Before leaving HDL, Cirincione was told that he would be a link between the people in the laboratories and those in the field, but, at that stage, no one really knew how the program was going to work. He said it was left up to him to set up the program. "That was the challenge," he said. In Cirincione's case there was a time difference of about 13 hours from Korea to the U.S. — his day was our night — which made communications back to the labs difficult.

"The only reliable mode of communications from Korea was ARPANET (a computer network through which unclassified messages could be sent). It took a while to establish points of contact at the laboratories and centers and inform the POC's we needed quick responses to our requests. Once that was established, we had daily communication with the centers and labs," Cirincione said. Cirincione requested assistance by sending a statement outlining the problem to all the Army RDE centers and labs. In some cases, problems were directed to only two or three specific centers or labs.

He said responses usually took two or three days. The responses wouldn't be total plans, but a variety of ideas and approaches that might offer a solution to the problem. "We'd review the initial responses, narrow them down and send them back to the centers or labs for a complete proposal on how to solve the problem." Cirincione said it would take a few months to a year, depending on the complexity of the problem, before he would receive a complete proposal.

Once a lab or center was selected to work out a solution, they were required to submit a time schedule, technical approach and budget to the director of the AMC-FAST Program. Each project received funding from a pot of money set aside by AMC for responses to the science advisors. Once a problem was solved, Cirincione would take the revised equipment to the field to try it out with the soldiers.

"It really meant a lot to me to have the people at the laboratories and centers respond. If everyone had ignored me then it would have been a disaster. So, I give a lot of credit for the success of the program to the responsiveness of the labs and centers," Cirincione said. "But (now) the commanders and troops want the advisors there. Replacements have already been requested and sent to a variety of commands."

During his assignment, he became involved in a number of issues of concern to the commander. These included the indications and warning posture of the command and the threat posed by the construction of infiltration tunnels through the demilitarized zone (DMZ). An independent study of the tunnel detection problem by several AMC laboratories, RDE centers and Corps of Engineers laboratories was initiated.

This resulted in an RDE program, under the U.S. Army Laboratory Command (LABCOM), to apply new technology to solve the problem.

A key program was initiated by HDL to provide a prototype modern ground surveillance radar to replace the obsolete systems now used by American troops near the DMZ.

Cirincione said, "This demonstration of the capabilities that new technology can provide will improve the readiness of the U.S. Forces in Korea." It will also provide to HDL radar designers valuable feedback on what features are important and how they should be improved for the next generation equipment, he said.

Cirincione said soldiers in the field are often indifferent to visitors from the RDE community. "The general attitude is 'here comes another one and we'll never see or hear from him again.'" His first contact with the soldiers evoked the same reaction, but things got better, he said. "My greatest pleasure was to be able to bring people from the laboratories with equipment for the troops and say, 'Here try this . . .' When they did, their whole attitude towards us changed. They became knowledgeable about what we could do for them and they welcomed us," Cirincione said. "It was the results that were important to them."

Cirincione pinpointed four critical areas for future advisors: first, advisors need a general idea of what the Army is up against in terms of problem areas on the battlefield; second, communications is one of the first areas that should be looked at — an indication that could be considered a warning or threat; third, the commands will expect quick solutions, so advisors must know in advance the procedures to get help from the laboratories. Finally, advisors must be able to use their judgment in determining whether they can solve a particular problem and whether or not it will take long term investment to solve it. "That intuition is very important," Cirincione said.

Twice in nine month intervals during their assignments, all the science advisors met to review each other's experiences and assess common problem areas. "That was important to us because that's when we were able to assist each other," Cirincione said.

Science advisors serve two-year tours for two reasons, he explained. One, advisors are sent to the field to gain an appreciation for the problems in the field and bring that knowledge and appreciation back to the labs. And the other is to establish a core of people in the laboratories with field experience. "We can't do that by sending the same people to the field. Sure, I would like to go to Europe, but I don't think I should — that's my point."

Summary

AMC is now studying how the program is working and what can be done to improve it. An investigative team has been appointed to assess the program. Team-leader, Richard Franseen of LABCOM, Clair Weiss, HQ, AMC, and COL (Ret.) John Ulrich, the first commander of HDL, will go to the field to talk to the scientists and commanders. Also, a comprehensive questionnaire has been prepared and will be distributed for further study. The program is being looked upon by AMC, DA, and the commanders in the field as a successful program, Cirincione said.

As the special assistant to the director at HDL, Cirincione is now tasked to improve the assessment, evaluation and application of technology to advanced concepts. He said that there is no doubt that the experience gained during his assignment in Korea will be his guide.

ANGIE F. LEVRONEY is a public affairs specialist in the Public Affairs Office at the U.S. Laboratory Command headquarters. A graduate of Howard University, she serves as editor of the installation newspaper and is currently initiating a command video program.

AMC May Expand Officer Development Program

A U.S. Army Laboratory Command (LABCOM) junior officer development program, begun in 1986 to send officers to the field for "muddy boot time," is now being suggested throughout the Army Materiel Command, according to a May 4 letter to the field signed by COL Clifton Houston, chief of AMC's Military Personnel Division.

CPT Susan Mesch of LABCOM's Military Personnel Office, a member of the Junior Officer Professional Development Committee at LABCOM, in Adelphi, MD, discussed the idea of field training for laboratory officers with other members of the committee after noticing the suggestion on an AMC matrix form in October 1985. The form listed numerous ideas to help train officers.

After much coordination with commanders of the 97th Army Reserve Command and First U.S. Army, both at Fort George G. Meade, MD, Mesch was able to link a captain from LABCOM's Human Engineering Laboratory, in spring 1986, with a reserve unit in Maryland for two weeks active duty training in the field.

Mesch said officers at LABCOM don't have the opportunity for field training and command normally experienced by officers early in their careers. This program, referred to as the U.S. Army Laboratory Command Officers Participation in Reserve Training, is intended to give officers with less than five years' commissioned service that opportunity.

To date, five LABCOM officers have participated, including soldiers, men and women, from the Human Engineering Laboratory and the Ballistics Research Laboratory, both located at Aberdeen Proving Ground, MD; Harry Diamond Laboratories; and Headquarters LABCOM, collated at Adelphi.

According to information presented by Mesch at a meeting of AMC's Reserve Component Policy Council shortly after the program began, objectives include:

- practical troop experience;
- maximum exposure to leadership;
- assignments as assistant evaluators, troop leaders, instructors and participants in field exercises; and
- exposure to the administration and operation of company- and battalion-size units.

Currently, the U.S. Army Forces Command, Fort McPherson, GA, is considering this program to train some of its officers, Mesch said.

For more information about the program, contact the LABCOM Military Personnel Office: AV 290-2456 or commercial 394-2456.

Impact of Logistics Requirements on Materiel Design

By Richard L. Nidever

Introduction

How many times have you read or heard that logistics support must be a primary consideration during materiel systems design? To those of us directly involved or even on the fringes of the Army's acquisition system, the answer is an unqualified "often."

As a matter of fact, the Army's logistics bible, AR 700-127, (Integrated Logistic Support) provides that: "Supportability is a principal design and program requirement as important as cost, schedule and performance. It will be a properly weighted consideration in the source selection process for a materiel system and in developing the acquisition strategy. Supportability will be a primary factor in all program and budget decisions, trade-off analyses, test and evaluation and other program events in the acquisition process." Most will agree this is a very powerful statement that gives logistics support the degree of emphasis and recognition it rightfully deserves.

However, this strong regulatory indorsement of logistics supportability (AR 700-127 is but one of many) has not been with us forever. Rather, it came about through a 15 to 20 year evolutionary process of sad experiences and lessons learned resulting from prior systems fieldings that lacked adequate advance logistics planning and follow-on support.

Design Influence

Of course, regulatory guidance is of little value unless it is followed or enforced. Enforcement is dependent upon the proper and timely execution of assigned responsibilities by all designated players in the materiel acquisition process. Some of the players' responsibilities are discussed later but let us first examine the definition of design influence as contained in AR 700-127:

"Design influence is the relationship of logistics-related design parameters of the system to its projected or actual readiness support resource requirements. These design parameters are expressed in operational terms rather than as inherent values and specifically relate to System Readiness Objectives and support cost of the system."

Then, at what stage of the acquisition process does logistic supportability considerations first influence systems design? The answer is very early — during the program initiation phase, following completion of the Operational and Organizational (O&O) Plan and during subsequent development of the System Concept Paper, Concept Formulation Package and the initial Integrated Logistic Support Plan among many other planning documents.

Further logistics influences on design occur during the concept exploration and demonstration and validation phases. When the system reaches the full-scale development phase, its design is essentially fixed as well as the items necessary for support, such as training devices, test equipment and computer resources.

Design influence results from a combination of actions by the combat developers (primarily the U.S. Army Training and Doctrine Command), materiel developers (primarily the U.S. Army Materiel Command) and program managers (PMs) designated by materiel developers. However, many design influencing actions occur prior to bringing the PM on board.

Establishment of a provisional PM office (PMO) and designation of an acting PM does not occur until the O&O Plan has been approved. The permanent PMO and PM do not come into being until a "Go Decision" is made at the full-scale development milestone review. Even though the permanent PM does not take office until other parties previously have made many design influencing decisions, the PM often bears the brunt of criticism for the earlier actions, both good and bad.

What are some of the early logistics design influencing actions and who are the responsible parties? Most actions result from the Logistics Support Analysis (LSA) Process (MIL-STD 1388-1A) and the Logistics Support Analysis Record (LSAR) (MIL-STD 1388-2A) a subset of the LSA documentation. Of 15 prescribed LSA tasks, seven are design related and of 14 LSA data records and reports, eight influence design. Let's take a good look at just one of the LSA tasks and one LSAR.

LSA Task 103, Program and Design Reviews, provides for: timely LSA program participation in the official review and control of design information; the scheduling of detailed LSA program reviews; and logistics risk assessments at program reviews. It also insures that all pertinent aspects of the LSA program

are addressed as an integrated part of all formal program and design reviews. These reviews are generally initiated during the Concept Exploration Phase (CEP) and are scheduled throughout subsequent acquisition phases. The combat developer is responsible for Task 103 during CEP and the materiel developer during subsequent phases.

LSAR Data Record B, Item Reliability (R) and Maintainability (M) Characteristics, is selectively applicable during CEP and is initiated by the combat developer. It describes the functions of each item under analysis, outlines the maintenance concept to be utilized, and identifies any design conditions and considerations imposed on the system. In addition, the B Record summarizes reliability and maintainability related availability characteristics resulting from failure modes, effects and critical analysis and maintainability predictions; provides for evaluation of logistics consideration impacting reliability and maintainability; and provides for a narrative related to any potential system redesign.

LSA Tasks

The LSA/LSAR process is highly structured to provide a tailorable capability in the analysis and documentation of weapon system supportability. LSA tasks are performed to identify the following at both the system and subsystem level:

- existing or proposed support structure and any associated constraints,
- total support requirements applicable to the elements of ILS, and
- significant support, cost, and readiness drivers of similar fielded systems to provide comparative baselines and establish ILS-related goals and thresholds for materiel system development.

The source of LSA data will change from engineering estimates through the test results to actual field use information. LSA documentation serves as the source of all support requirements.

LSAR

The LSAR as a subset of LSA documentation provides for the documentation of detailed engineering and logistic support requirements data generated by the LSA process. The purpose of the LSAR is to provide a uniform, organized, yet flexible, technical data base which consolidates the engineering and logistics data necessary to identify the detailed logistic support requirements of a system. The LSAR data base is used to:

- determine the impact of specific design features on logistic support;
- determine how the proposed logistics support system affects system RAM characteristics;
- provide input data for tradeoff analyses, life cycle studies, and logistic support modeling;
- exchange valid data among functional organizations;
- provide source data for the preparation of logistics products; and
- influence the design.

The LSAR also documents the detailed logistic support requirements data generated by the LSA process. The LSAR data resulting from each iteration of the LSA tasks is used as input to follow-on analyses and as an aid in developing logistic products. Where the LSA process analysizes and documents the potential influence of logistics considerations on design, the LSAR technically forces and records logistics analysis and its influence on the design of a weapon system.

In any major program, life cycle cost (LCC) estimation gains greater attention as weapon system costs increase. Life cycle cost should be the principal criterion and weighted accordingly in materiel and support system selection. The LSA documentation, including the LSAR, can serve as valuable source data for developing operating and support cost estimates.

The "cost of logistics" has been a hidden factor in almost every major weapon system previously developed and deployed. Various DOD initiatives (Carlucci, OSD Acquisition Improvement Program, Packard Commission) have addressed the need to accurately determine logistics resource requirements and costs but much remains to be done in this area. For now, suffice to say that a timely, well executed LSA program assists in design influence and in determining logistics requirements and their associated costs.

Summary

As this brief discussion of supportability and the LSA/LSAR process indicates, abundant tools and authority exist for the combat developer, materiel developer, PM and his logistics staff to exert design influence during the acquisition process. These include:

- a mandate to consider and acquire weapon system supportability,
- authority to pursue design influence (AR 700-127), and
- detailed technical procedures to exert design influence (MIL-STD-1388-1A/2A).

Acquisition task forces, study groups, teams, PMs and logisticians must assure their efforts are directed towards making supportability an active and effective part of materiel system research, design, production, deployment and sustainment. They must exert influence very early during the acquisition process to assure properly designed and operable systems that can be sustained at minimal operating and support costs. This is especially essential now and in the foreseeable future as defense budgets receive ever increasing Congressional scrutiny and funding allocations are reduced.

Although PMs must orchestrate and guide most of the acquisition actions, they cannot guarantee system supportability without much assistance and cooperation from the entire acquisition community (combat developers, materiel developers, industry and others). With this total team effort, however, the goal of properly designed, operable and sustainable systems at the least possible support costs will be realized.

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CERL Return on Investment Studies

Each year since 1976, the U.S. Army Construction Engineering Research Laboratory (CERL) has asked independent contractors to evaluate how selected products developed under CERL's research and development program have performed in the field. These contractors have compared the costs of the research with the benefits supplied by the CERL product to arrive at a Return-On-Investment (ROI) ratio.

Overall, CERL's typical ROI for its research has been 73:1, with a range from 2:1 to 1405:1. This figure is based on 20 products that have been placed in the field; it is considered representative of the benefits CERL research and development provides to the Army. The following summary presents the ROIs of nine products.

Corrosion Research (March 1987)

This ROI issue described the development of recommendations to reduce the corrosion of structures at a military facility used by Omani defense forces on Masirah Island, Oman. CERL researchers inspected existing facilities at Masirah Island and recommended changes in plans and specifications for new construction that would help mitigate climate-induced structural corrosion.

The recommendations included replacing certain galvanized steel and stainless steel components with materials that are more resistant to corrosion and applying corrosion-resistant or protective coatings to various exposed structural surfaces. Implementation of CERL's recommendations into new construction avoided more than $8.4 million. The research costs were $71,270. Thus, the ROI was 117.9:1.

The calculation of the major savings in time and money provided by incorporating these recommendations was in the capital expenditures for labor required to totally replace failed components and for the cost of replacement materials. In addition, the calculation included the increased structural lifetime with the attendant reduction in administrative and procurement effort required when components must be replaced.

Transformer System (May 1986)

CERL developed the polychlorinated Biphenyls (PCB) Transformer System to help the U.S. Army Materiel Command evaluate the status of PCB transformers on its installations. The information would be used to facilitate response to federal regulatory requirements. The PCB Transformer System incorporates various pertinent medical, engineering, economic, and regulatory data pertaining to PCBs into an easy-to-use, interactive, answer-driven system that provides output in a fraction of the time needed to perform the same work manually.

The system cost $40,000 to develop, and only negligible costs are incurred to use it in the field. The system saves $413 per transformer analyzed, so its use by AMC to analyze its 4,856 transformers will save more than $2 million. The resulting ROI is 50:1.

In addition to the major labor cost reductions the system provides, it supplies the printed documentation needed to support decisions regarding the disposition of transformers. It also allows the engineer to examine many more options for the transformers than was previously possible and increases the efficiency with which the transformers can be removed or replaced. The system is easily accessible through interface with CERL's Environmental Technical Information System, which is already widely used at military installations.

The SOLFEAS Program (October 1985)

This ROI issue described the development of SOLFEAS — a computer program designed to provide a fast, inexpensive method to assess the economic feasibility of using solar technology instead of fossil fuels for heating and cooling in new military construction. SOLFEAS contains weather data, default values for auxiliary fuel costs and escalation rates, and various economic factors. The only user inputs required are monthly values for total building space heating, cooling, and service hot water loads, and the Weather Service station number for the location of the new construction.

Research costs to develop the program were $65,000. The system saves $2,228 per analysis and will save the Corps of Engineers $3.047 million over five years, given that public law requires an evaluation to be made for all military construction projects for which use of solar energy may be feasible. This provides an ROI of 47:1.

Use of SOLFEAS provides significant labor savings, thus greatly reducing the costs of performing each solar feasibility analysis. Formerly, such analyses had to be done manually by high-graded professional engineers. However, since the program can now be run by lower-graded personnel, costs are decreased and the engineer's time is freed for other projects.

Vehicle Washing and Maintenance (May 1985)

Concepts were developed for designing new washing and maintenance facilities for Army vehicles that would comply with new, stringent environmental legislation regulating wastewater discharges. These concepts physically separate vehicle washing and maintenance activities, providing environmentally acceptable waste streams and more economical cleaning and servicing. Implementation of these facilities at Fort Lewis, WA, and Fort Polk, LA, has provided an overall ROI of 11:1.

The benefits to Fort Polk of using the new facility were $10.44 million, and the benefits accruing to Fort Lewis were $14.496 million. Calculation of the ROI was based on developing and designing wash facilities at both installations and developing a maintenance facility at

Fort Lewis.

The centralized washing facilities require much less water, provide a much cleaner discharge, and increase the chances of spotting maintenance problems, thereby decreasing vehicle downtime. The improved maintenance facility design provides substantial water savings, reduces the size requirements for oil/water separators, eliminates the need for using solvents for cleaning, and increases the amount of waste oil captured. The amount of time and labor needed to wash and service Army vehicles has been reduced by an average of 80 percent.

Programmable Calculators (February 1985)

CERL, in conjunction with the U.S. Army Engineer School, investigated the benefits of having combat engineer troops use hand-held programmable calculators to solve logistical and management problems. The research involved developing six program areas in support of Field Manual 5-34 (a combat engineer's reference handbook), field-testing the programs, and incorporating improvements.

Costs to complete this study were $236,000. Estimated annual savings to the Army and Reserves would total $1.055 million, given that about 700 read-only memories were furnished to individuals and organizations for use in combat engineer units. Over the eight years projected for the useful life of this calculator technology, the total benefit would be $7.17 million, to provide an ROI of 4:1.

The main benefit identified was the potential for direct time savings at the operational level. An average of 70 percent of the manual calculation time would be saved if the programmable calculator were used in technical areas that have been programmed. Other time savings could be realized in strategic planning and more efficient use of resources.

Solar-Assisted HVAC System (June 1984)

An energy savings plan was developed using retrofit controls and other technology to regulate heating, ventilating, and air-conditioning systems (HVAC) at three U.S. Army Reserve centers. Its purpose was to find out why systems with solar-assisted technology had higher than average power bills.

Analysis showed that the HVAC systems consumed about 54 percent of all electricity. Therefore, six major HVAC features were analyzed for operating efficiency based on electrical energy use, maintenance, and natural gas consumption. Researchers then suggested nine major changes to the HVAC system. Study costs were $23,810, and the total cost of implementing the recommendations was $116,620. Total savings calculated for the three USAR centers over the 12-year life of the improved facilities were $549,080, so the ROI was 18:1.

Implementation of USA-CERL's recommendations will significantly reduce energy consumption at the three installations studied. Smaller-scale savings may also accrue, such as savings in staff hours now devoted to calling in repairs, checking work, keeping records, and other labor involved when dealing with outside agencies.

Stainless Steel in a Wind Tunnel (December 1983)

CERL performed a modified material selection study for the Air Force Arnold Engineering Development Center. The study compared the properties of type 316L stainless steel as a proposed substitute for the type 316 stainless steel specified for construction of a wind tunnel. Researchers found that the material proposed for substitution did not meet design and code criteria for such facilities. They then recommended modifying construction details for the design materials originally specified in ways that would extend the useful life of the facility without significantly changing the design or construction method.

Study costs were $15,000, and the ROI was calculated in two ways. The first method is calculated for redesign of a structure to permit use of type 316L steel; here, cost avoidance would be $70,000, to provide an ROI of 4.7:1. The second method is based on redesign and reconstruction of wind tunnel elements after failure of a structure built with type 316L stainless steel. Here, costs avoided are $21.07 million, to provide an ROI of 1405:1.

Fort Carson Particulates (August 1983)

This ROI issue described a CERL investigation to determine whether activities at Fort Carson, CO, were causing unacceptable Total Suspended Particulate (TSP) levels on surrounding communities. The research indicated that Fort Carson was in compliance with all TSP standards set by the State of Colorado and the U.S. Environmental Protection Agency (USEPA) and that the cause was from outside the installation.

Major sources of TSP on the installation were training exercises and cantonment activities, and strategies were developed that would reduce the effects of these activities on regional TSP standards. The overall study costs were $94,650. If monitoring data had shown Fort Carson to be a major cause of the region's non-compliance, the installation would have had to spend between $5.75 and $7 million for paving 43.2 miles of road in order to reduce dust levels. Thus, the ROI was 61:1 to 75:1.

The study also showed that samplers used in the state's monitoring program had not been located according to USEPA criteria. CERL therefore recommended the development of TSP ambient standards based on geometric, rather than arithmetic means, which would produce a much more reliable view of ambient air quality.

Housing Maintenance Guide (February 1983)

This ROI issue described the Housing Maintenance Contract Guide developed by CERL for the U.S. Army Forces Command (FORSCOM). The guide, along with information and techniques gathered during the guide's development, were used to help initiate the first contract operations for family housing maintenance at selected FORSCOM installations.

CERL developed a Lump Sum Performance Contract for 1,000 of the 5,238 family housing units at Fort Hood, TX, and a Unit Price Performance Contract for 759 of the 1,829 family housing units at Fort Carson, CO. The guide documented the development of these test contracts and served as a self-help manual for installation contract and procurement officers.

Research costs associated with developing the guide were $100,000. Contract costs were between $2 million and $6.3 million less than previous government estimates for the work. Therefore, the ROI for this research was between 20:1 and 63:1.

Contracting is saving both Fort Hood and Fort Carson significant amounts on family housing maintenance. If contracting were used for all 40,000 FORSCOM family housing units, the potential savings are $19 million annually.

Career Development Update

From the FA51 Proponent Office . . .

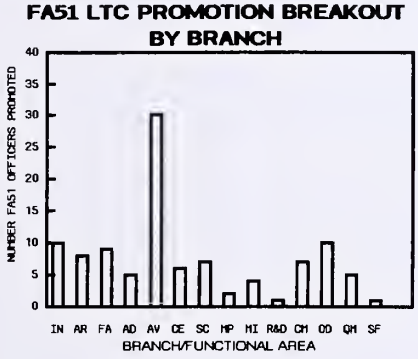
Lieutenant Colonel Promotion List

Results from the 1987 Lieutenant Colonel, Army Competitive Category, Promotion Board were recently released and continue to show favorable trends in the Research and Development Functional Area.

Overall selection rate for first time considered R&D officers was 75.5 percent as compared to an Army average of 69.5 percent. Preliminary review indicates a selection rate of 75.9 percent for area of concentration (AOC) 51A and 92.8 percent for AOC 51B.

Additionally, FA51 LTCs had a minimum floor of 51 promotions. Promotion floors are established to reduce career field underalignment and to ensure acceptable progression of officers in each year group.

Above the Zone			Promotion Zone			Below the Zone		
ELIG	SEL	% SEL	ELIG	SEL	% SEL	ELIG	SEL	% SEL
64	4	5.8	131	99	75.5	111	2	1.8



Acronym Key for Branches/Functional Areas

IN - Infantry
AR - Armor
FA - Field Artillery
AD - Air Defense Artillery
AV - Aviation
CE - Communications/Electronics
SC - Signal
MP - Military Police
MI - Military Intelligence
R&D - Research and Development
CM - Chemical
OD - Ordance
QM - Quartermaster
SF - Special Forces

Research Topics Revisited

The FA51 Personnel Proponent Office is still seeking suggested research topics for use by FA51 student officers pursuing advanced civilian education at the Masters/Doctorate level. We have received many inquiries from student officers looking for topics since we first asked. We still have not received any topic suggestions/sponsors. Organizations with research and development or test and evaluation related problems in the engineering, sciences, or business areas could benefit significantly by suggesting/sponsoring research topics for study by those students. Proposed topics should include the following information:

- Thesis Topic
- Sponsor (organization and point of contact)
- Topic Description
- Enumerated Objectives
- Resource Requirements (e.g. TDY, other)

Your support of this program is an opportunity to insure new emerging technologies.

R&D Training With Industry

Congratulations to the officers selected for participation in the 1987-88 Research and Development Training with Industry (TWI) Program. Officers selected for one year of training and their training sites are shown below.

Westinghouse Defense	Baltimore, MD	MAJ Thomas Barfield
Martin Marietta	Orlando, FL	CPT Gary Taylor
Litton Data Systems	Van Nuys, CA	CPT John Miller
McDonnell-Douglas	Titusville, FL	MAJ Andrew Ellis
Tracor Aerospace	Austin, TX	LTC James Emerson
Sikorsky Aircraft	Stratford, CT	MAJ Wade Brinson
LTV Aerospace	Dallas, TX	CPT Edmund Dowling

Upon completion of training, these officers will be utilized in key acquisition positions which interface with defense industry.

Emerging Technologies and Education

The Army is taking an in depth look at emerging technologies and the educational needs to keep pace with these new technologies. Army leadership is looking for ways to better utilize the nation's scientific and technological capabilities. In the near future, GEN Louis C. Wagner Jr., AMC commander, will co-chair a meeting to discuss emerging high-leverage technologies, key research needs, corresponding world class universities, and technology leaders within defense industry. Plans call for development of a detailed program that will answer the questions: What are the emerging technologies of the future?....What are the requirements for this technology?. . . . and, How do we infuse them into the Army through advanced civil schooling and training with industry. As research and development, test and evaluation officers we can look forward to the development of a plan for inserting emerging technologies through our educational system which will carry us well into the 21st century.

From the Field . . .

Generators Refitted With Improved Governor

The Army's inventory of 15, 30 and 60 Kilowatt generators have been refitted with a new, improved governor adapted for military use by the Troop Support Command's Belvoir RDE Center. The new commercially-designed electronic governor is more reliable, easier to maintain, less expensive, and lighter in weight than the electro-hydraulic system which was previously used.

Under the retrofit program, the control unit, actuator, hydraulic pump, fluid tank, cooler (60 Kilowatt), filter, oil fittings and hoses, and the electric cable harness of the electro-hydraulic system were replaced with a simpler electronic system consisting of a control unit, actuator, speed sensing device and electric cable harness.

Tests showed the new governor will run an average of 8,592 hours between failures compared to 3,887 for the electro-hydraulic unit. In addition, the electro-hydraulic unit was more difficult to adjust, required external equipment and demanded a higher degree of skill to maintain.

The weight of the system varies with the model of generator, but on the average, the new generator weighs 83 percent less than the old design. Finally, center engineers estimate the new governor will save the Army nearly $1 million over the next five years because it costs about half as much as the electro-hydraulic unit.

Nearly 2,400 generators already in the Army's inventory were retrofitted under this program. New generators will be equipped with the governor when built.

Army Fields New Rocket-Propelled Line Charge

The 9th Infantry Division has received the first units of a new rocket-propelled mine clearing line charge scheduled to be fielded throughout the Army. The system, called MICLIC, is a joint Army-Marine Corps development adopted for the Army by the Troop Support Command's Belvoir RDE Center.

The system features a Marine Corps launching system and explosive line charge mounted on a standard Army trailer. In operation, a rocket propels the line charge across an enemy minefield from a standoff position. Command detonation of the charge causes the mines to detonate forming a vehicle-wide path.

The assembled system can be towed by a light forces engineer vehicle, a tank, or an armored personnel carrier, and is designed to clear a path 100 meters long by eight meters wide. Three new safety improvements that will be incorporated in MICLIC during the fielding process are an improved fuze, an arresting cable disconnect, and a trailer disconnect. The Army plans to field about 1,400 systems.

Landmark Mask Contract Awarded at Edgewood

What is believed to be the largest single production contract for protective masks ever awarded in the Edgewood Area of Aberdeen Proving Ground, MD, will result in a new generation of protective masks for the U.S. Army and Marine Corps. Fielding is scheduled for June of next year.

Scott Aviation, with corporate headquarters in Lancaster, NY, was awarded a contract valued at approximately $52 million for production of 300,000 M40 and M42 protective masks.

The contract was signed at the U.S. Army Armament, Munitions and Chemical Command Procurement Directorate at Edgewood by A. Radford Baker, the Army's contracting officer for the project, and by M.R. (Jim) Kaletta vice-president of sales and marketing for Scott Aviation.

The M40 mask was developed for use by the infantryman, while the M42 mask was developed for the combat vehicle crewman. These masks replace three different types of masks (the M9A1, the M17A2, and the M25A1), which have been in the field for about 25 years.

Career Development . . .

Reverse Engineering Handbook Published

A reverse engineering handbook has been developed by the U.S. Army Materiel Command (AMC) as part of AMC's ongoing effort to increase competition and reduce spare parts costs.

Developed specifically by the Belvoir Research, Development and Engineering Center, the handbook provides guidelines and procedures for performing reverse engineering — the process in which drawings and specifications are made as a result of physically examining and measuring existing parts to produce technical data that are no longer proprietary.

When a contractor legitimately places a proprietary stamp on a technical data package (TDP), the government is, in effect, forced into a position of having to purchase those parts from that contractor on a sole source basis. Reverse engineering enables the government to obtain technical data that can be used to solicit competitive bids for those parts. Reverse engineering thus permits the government to obtain its own TDP.

The handbook was devised using current applicable laws and knowledge gained under the Army's Reverse Engineering Pilot Program and is based on experience gained by AMC major subordinate commands and industry participants. The handbook is intended for use by in-house government personnel, engineering service contractors and manufacturing contractors engaged in reverse engineering of Army materiel. It is sequentially arranged in the same order in which a reverse engineering process would be conducted.

Copies of the publication, MIL-HDBK-115 (ME) "U.S. Army Reverse Engineering Handbook (Guidelines and Procedures," are available from: Commanding Officer, U.S. Naval

Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.

Questions regarding the handbook should be addressed to: Commander, U.S. Army Materiel Command, ATTN: AMCPP-MC, 5001 Eisenhower, Ave., Alexandria, VA 22333-0001.

Artificial Intelligence Training Opportunities

The Army Research Office (ARO) recently announced the FY 88 schedule for artificial intelligence (AI) training. A summary of the course titles, locations and dates is presented below. If you have any questions about the training program, contact the ARO program manager, Dr. C. Ronald Green, at AV 935-3331 or (919)549-0641.

FY 88 Artificial Intelligence Education Courses

Date	Location	Title
Nov. 4-6	University of Texas Austin, TX	Natural Language Understanding and Translation
Nov. 17-19	University of Pennsylvania Philadelphia, PA	Multisensory Integration
Dec. 14-16	University of Pennsylvania Philadelphia, PA	Computer Architectures for Parallel Processing in AI Applications
Jan. 4-8	University of Texas Austin, TX	Knowledge Acquisition and Knowledge Representation
Mar. 8-10	Combined Arms Center Fort Leavenworth, KS	Man-Machine Interfaces: Graphics, Expert Systems and Natural Language
Mar. 21-23	Army Research Institute Alexandria, VA	Overview of Machine Learning
Apr. 6-8	Army Management Engineering Training Activity Rock Island, IL	Introduction to Expert Systems
May 9-13	University of Pennsylvania Philadelphia, PA	Data Bases and Knowledge Bases
Jun. 6-10	University of Pennsylvania Philadelphia, PA	AI Applications of Logic Programming
Jul. 18-22	University of Texas Austin TX	Object Oriented Programming in LISP

In 1984, ARO competitively selected two artificial intelligence centers of excellence. Five-year contracts were awarded for basic research by co-principal investigators, fellowships and assistantships for graduate students, hardware procurement, and training of government personnel.

These AI centers are located at the University of Pennsylvania and the University of Texas at Austin. The centers will provide three-day and one-week training programs during FY 88, which is the fourth year of the five-year contracts.

Army Names Top Science and Humanities Students

The silver anniversary of the National Junior Science and Humanities Symposium (JSHS) was celebrated on May 8, 1987, at the U.S. Military Academy, West Point, NY. More than 230 students competed for top honors during the three-day symposium. Winners of the 46 regional JSHS competitions sponsored by the U.S. Army met at West Point to compete for a trip to the London International Youth Science Fortnight held July 2 - Aug. 5, 1987, in London, England. In addition to student representatives from nearly every state, students from Europe and Japan and their teacher-advisors also attended.

The JSHS program began 29 years ago at Duke University under the auspices of the Office of Ordnance Research, which is now the U.S. Army Research Office. Through continued support from the U.S. Army, the program has continued to grow such that nearly 8,000 students took part in this year's competition. The program is a prime example of the Army's long-standing interest in American youth and in fostering continuing interest in science and humanities.

Assistant Secretary of the Army (Research, Development and Acquisition) Dr. Jay R. Sculley presented the certificates of accomplishment to the London trip winners. This was the fifth consecutive year in which Dr. Sculley has personally presented these awards and further encouraged these outstanding student representatives to continue their educational pursuits in the nation's colleges and universities.

The presiding chairman of the awards banquet was Dr. Robert E. Weigle, director, U.S. Army Research Office.

Winners of the Army's 25th Junior Science and Humanities Symposium were: Charles E. Dickerson, Jr., Clinton High School, Clinton, MS; Walter S. Ripple, Brazoswood High School, Clute, TX; Ashok B. Pillai, St. Pius X High School, Albuquerque, NM; Max A. Pugh, Jr., Oxon Hill High School, Oxon Hill, MD; Tamara J. Schmitt, Laurel Concord Public School, Laurel, NE; Christine M. Stoffel, Bettendorf High School, Bettendorf, IA; and Julie C. Jangula, Captain Schreve High School, Shreveport, LA.

Conferences & Symposia . . .

Call for Papers

The Sixth Annual National Conference on Ada Technology will be held March 14-17, 1989 in Washington, DC. The theme of the conference is "Ada in the Life Cycle."

Abstracts of 300-500 words in length should be submitted by Sept. 30, 1987, to the Sixth Annual National Conference on Ada Technology, U.S. Army Communications-Electronics Command, ATTN: AMSEL-RP-LC-ASST-IA (Al Rodriguez), Fort Monmouth, NJ 07703.

For more information, contact Al Rodriguez at (201)532-4725.

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